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January 27, 2011

Dawn Richmond  
United States Environmental Protection Agency  
Region 9  
75 Hawthorne Street  
San Francisco, CA 94105

**Subject: King Tutt Mesa Site, Reassessment Report**  
**EPA ID NO.: NND986667434**

Attached is the Reassessment Report for the King Tutt Mesa Site, prepared by Weston Solutions, Inc. Also included are the Transmittal List, Site Reconnaissance Interview and Observation Report, Contact Log, Contact Reports, Analytical Data, References and the Environmental Protection Agency Quick Reference Fact Sheet.

If you have any questions regarding this report, please do not hesitate to contact me at (510) 788-3807 or [alex.grubb@westonsolutions.com](mailto:alex.grubb@westonsolutions.com).

Respectfully submitted,

Alex Grubb  
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A handwritten signature in blue ink, appearing to read "Alex Grubb", is written over a faint, larger blue outline of the signature.

Attachments



**Reassessment Report  
King Tutt Mesa Site  
Oak Springs, Apache County, Arizona**

**EPA ID No.: NND986667434  
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U.S. Environmental Protection Agency  
Region 9**

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A 2010 Gamma Radiation Survey - Measurements and Figures A-1 through A-46

## Appendix

A Transmittal List

B Site Reconnaissance Interview and Observation Report/Photographic Documentation

C Contact Log and Contact Reports

D Analytical Data

E References

F EPA Quick Reference Fact Sheet: (Site Assessment: Evaluating Risks at Superfund Sites)

## **List of Acronyms**

AUM	Abandoned Uranium Mine
BEI	Bechtel Environmental, Inc.
BIA	U.S Department of Interior, Bureau of Indian Affairs
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CLP	Contract Laboratory Program
cpm	counts per minute
EPA	U.S. Environmental Protection Agency
ESI	Expanded Site Inspection
GPS	global positioning system
HRS	Hazard Ranking System
KTM	King Tutt Mesa
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
NAMLRP	Navajo Abandoned Mine Lands Reclamation Program
NAREL	National Air and Radiation Environmental Laboratory
NNEPA	Navajo Nation Environmental Protection Agency
NPL	National Priorities List
NSP	Navajo Superfund Program
OSM	U.S. Department of Interior, Office of Surface Mines
PA	Preliminary Assessment
pCi/g	picoCuries per gram
pCi/kg	picoCuries per kilogram
pCi/l	picoCuries per liter
QC	quality control
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
SAS	Special Analytical Services
SI	Site Inspection
SMCRA	Surface Mining Control and Reclamation Act
µg/l	micrograms per liter
µR/hr	micro roentgen per hour
VCA	Vanadium Corporation of America
WESTON	Weston Solutions, Inc.

## **1.0 INTRODUCTION**

Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), Weston Solutions, Inc. (WESTON) was tasked to conduct a Reassessment of the King Tutt Mesa Site, located in Oak Springs, Apache County, Arizona.

The KTM Site was identified as a potential hazardous waste site and entered into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) on February 1, 1989 (EPA ID No.: NND986667434). The KTM Site consists of 16 abandoned uranium mine (AUM) sites that are either contiguous or in close proximity to each other; therefore, the U.S. Environmental Protection Agency (EPA) determined to evaluate them as a single, aggregate site. The 16 sites, which are comprised of 28 individual mine sites, are as follows: Navajo - Begay Incline Uranium Mine, Navajo - Begay #1 Uranium Mine, Navajo - Begay #2 Uranium Mine, Navajo - Canyon View (Alongo Claim) Uranium Mine, Navajo - Carrizo Mine, Navajo- Franks Point/VCA Plot 6 Uranium Mine, Navajo- Junction Claim Uranium Mine, Navajo - King Tutt #1 Uranium Mine, Navajo – King Tutt Point Uranium Mine, Navajo - Red Wash Point Uranium Mine, Navajo - Salt Canyon Mines, Navajo - Tent Uranium Mine, Navajo - Upper Salt Rock Uranium Mine, Navajo - Vanadium Corporation of America (VCA) Plot 3, Navajo - VCA Plot 7 Uranium Mine, and Navajo - Williams Point Mine (VCA #4) (1, 2, 3).

The Navajo Nation Environmental Protection Agency (NNEPA), Navajo Superfund Program (NSP) conducted Preliminary Assessments (PAs) on the 16 sites during 1989 and 1990. In 1991 and 1992, the NSP conducted four sampling SIs and eight non-sampling SIs at sites that comprise the aggregate KTM Site. Additionally, in 1996, the EPA completed an Expanded Site Inspection (ESI) of the KTM Site (2, 3).

After reviewing the PAs, SIs, and ESI, the EPA decided that further investigation of the KTM Site would be necessary to more completely evaluate the site. The purpose of the Reassessment is to review existing information and collect additional information on the site and its environs using the EPA's Hazard Ranking System (HRS) criteria to assess the relative threat associated with actual or potential releases of hazardous substances at the site. The HRS has been adopted by the EPA to help set priorities for further evaluation and eventual remedial action at hazardous waste sites. The HRS is the primary method of determining a site's eligibility for placement on the National Priorities List (NPL). The NPL identifies sites at which the EPA may conduct remedial response actions. This report summarizes the results of the Reassessment for the KTM Site.

More information about the Superfund program is available on the EPA web site at <http://www.epa.gov/superfund>. The fact sheet attached in Appendix F describes EPA's site assessment process.

## **1.1 Apparent Problem**

The apparent problems at the site, which contributed to the EPA's determination that a Reassessment was necessary, are presented below:

- The site consists of 16 mines that were operated from the 1940s to the 1960s. During the mining operations, higher grade uranium and vanadium ore was extracted and shipped off site for processing. Waste piles consisting of lower grade ore and overburden remained on site after operations ceased (2, 3, 4, 5).
- Waste piles remaining on site potentially contain hazardous substances, such as radioactive materials and heavy metals. Additionally, erosion that occurred during and after the mining operations may have released these hazardous substances to the surrounding environment (2, 3, 4, 5)
- There are residences located on site. Additionally, the site is used for livestock grazing (2, 3).

## **2.0 SITE DESCRIPTION**

### **2.1 Location**

The KTM Site is located in Oak Springs, Apache County, Arizona, which is approximately 8.5 miles north of Red Rock, Apache County, Arizona. The approximate geographic coordinates for the center of the site are 36° 43' 16.84" north latitude and 109° 02' 1.39" west longitude (6). The location of the site is shown in Figure 2-1.

### **2.2 Site Description**

The KTM Site occupies approximately 3,500 acres in a sparsely populated rural area near the community of Oak Springs, which is in the Red Valley Chapter of the Navajo Nation. The site consists of 16 AUMs that are being evaluated as a single, aggregate site for the following reasons: 1) the sites are either contiguous or in close proximity to each other, 2) similar operations occurred on each site, 3) the hazardous substance sources have similar waste characteristics, containment, and target populations, 4) the sites are in the same watershed, and 5) the sites overlie the same aquifer. The sites are located in an area of rugged terrain that is accessible via dirt roads. A total of 34 mine claims, comprised of 41 individual mine sites are located within the KTM Site boundary. There are approximately 200 individual mine features, such as portals, prospects, rim strips, and vertical shafts that are located throughout the 16 sites (2, 3, 4, 5).

The KTM Site is bordered on the west by Highway 63 and the community of Oak Springs, on the north by open rangeland, on the east by Red Wash, and on the south by Blackrock Wash and its tributaries. The Oak Springs Wash flows through the site, from the west to the east, and enters the Red Wash on the eastern border of the site. The site is used by local residences for livestock

grazing. Several residences, some with agricultural fields, are located near the site (2, 3, Appendix B). The site layout is shown in Figure 2-2.

## **2.3 Operational History**

Uranium mining on the Navajo Nation began in the early 1900's. Mining occurred throughout the Navajo Nation, with peak activities between the 1940's and 1960's coinciding with the development of nuclear weapons and energy. The U.S. Department of Interior, Bureau of Indian Affairs (BIA) and the Navajo Nation negotiated mining leases and permits with private mining companies who operated the mines. These companies processed uranium ore at mill sites or sold raw uranium ore to mills. From 1947 to 1970, the former U.S. Atomic Energy Commission (AEC) was the sole market for uranium concentrate (yellowcake) that was processed from the Navajo Nation. After 1970, uranium concentrate was sold to electric utilities. Vanadium that was recovered from the ore was sold to the steel industry (4, 5).

The KTM Site is located on land held in trust for the Navajo Nation by the BIA. Several companies operated uranium mine claims throughout the site from the early 1940's to the late 1960's; however, the former Vanadium Corporation of America operated a majority of the mines. Portals (adits), rim strips, and vertical shafts were used to obtain ore from the Salt Wash Member of the Morrison Formation. Operations at the site consisted of conventional blasting techniques combined with manual labor to remove overburden and ore. Navajo workers manually sorted the higher grade uranium and vanadium ore into piles that were transported to off-site mills. Lower grade ore and overburden remained on site in waste piles near the mine workings, on steep slopes, and in surface drainages (2, 3, 4, 5).

## **2.4 Regulatory Involvement**

### **2.4.1 U.S. Environmental Protection Agency**

The KTM Site is not listed in the Resource Conservation and Recovery Information System (RCRIS) database dated January 11, 2011 (7).

### **2.4.2 Navajo Abandoned Mine Lands Reclamation Program**

The Navajo Abandoned Mine Lands Reclamation Program (NAMLRP) was established in August 1988 as a program under the Navajo Nation Division of Natural Resources. The program was developed to fulfill the requirements of the Surface Mining Control and Reclamation Act (SMCRA) of 1977. Through SMCRA, the U.S. Department of Interior, Office of Surface Mines (OSM) directed the NAMLRP to inventory and prioritize abandoned mine sites according to OSM criteria. A system for prioritizing non-coal mine sites was developed. Priority 1 sites were identified as having extreme physical hazards, easy access, and danger to life and property. Priority 2 and 3 sites had less physical danger, more difficult access, and lower visitation. Starting in 1988, the NAMLRP began reclaiming abandoned coal and non-coal sites throughout the Navajo Nation (2, 3, 4, 5).

An inventory of the KTM Site, conducted by the NAMLRP, identified approximately 200 mine features that were eligible for reclamation under the OSM criteria. The mine features included portals, prospects, rim strips, and vertical shafts. In 1992, the NAMLRP began conducting reclamation work at individual mine sites located within the KTM Site boundary. Reclamation activities conducted by the NAMLRP included backfilling portals, prospects, and rim strips with radioactive mine waste (lower grade uranium ore) that remained on the sites. Non-contaminated soil was used as cap in several areas. Additionally, the NAMLRP closed certain areas with polyurethane foam plugs, diverted drainage from the backfilled areas, and seeded areas for re-vegetation (2, 4, 8).

The NAMLRP required that sites be reclaimed so that the residual gamma emission from the reclaimed surfaces did not exceed 50 micro roentgens per hour ( $\mu\text{R/hr}$ ). In addition, the NAMLRP required that the residual Radium-226 concentration in the first 6 inches of reclaimed soil did not exceed 25 picoCuries per gram ( $\text{pCi/g}$ ) in order to be considered reclaimed. Much of the work was conducted through contracts with local construction companies. By 2002, the NAMLRP completed reclamation activities at the KTM Site. As shown in Table 2-1 and Figure 2-2, each of the 16 sites that comprise the KTM Site were reclaimed by the NAMLRP, with the exception of mine site Oak 156, which is part of the Navajo - VCA Plot 3 site. In addition to these sites, the NAMLRP conducted reclamation work at the following seven sites that fall within the KTM Site boundary: VCA Plot 10, Lower Salt Rock, NA-0824, NA-0828, Red Rock, Red Wash (Hosteen S. Begay), and Red Wash (Leroy Pettigrew). Four sites, Oak 124/125, Oak 143/146, Oak 230, and Oak 238, remain unreclaimed, potentially due to fewer hazards or more difficult access. Table 2-2 summarizes these additional mines. As recently as 2006, the NAMLRP conducted maintenance at the KTM Site to address erosion and other issues impacting the reclamation work (3, 4, 5, 8, 9).

### **3.0 INVESTIGATIVE EFFORTS**

Numerous investigations have been conducted throughout the KTM Site over the past two decades. As stated above, the NSP conducted PAs on the 16 sites during 1989 and 1990. In 1991 and 1992, the NSP conducted four sampling SIs and eight non-sampling SIs at sites that comprise the aggregate KTM Site. In 1994, the EPA conducted a sampling event at the site as part of an ESI, which was completed in 1996. Again in 2004, the NSP conducted an additional sampling event at the KTM Site as part of an on-going SI Reassessment. In support of the on-going SI Reassessment, the EPA performed a gamma radiation screening survey in 2008 at several of the reclaimed sites within the KTM Site boundary. Below is a summary of the sampling and screening activities conducted at the site (2, 3, Appendix B).

#### **3.1 Navajo Superfund Program – 1990 Sampling**

During July and August 1990, the NSP collected soil, sediment, surface water, and groundwater samples as part of separate SI investigations on the Navajo - Begay #1 Uranium Mine, Navajo - Begay #2 Uranium Mine, Navajo - VCA Plot 3, and Navajo - VCA Plot 7 Uranium Mine sites. The

samples were analyzed for Routine Analytical Services (RAS) metals and Special Analytical Services (SAS) isotopic uranium and thorium using Contract Laboratory Program (CLP) laboratories (2, 3).

### **3.1.1 Soil/Sediment Sampling**

The NSP collected a total of 29 soil samples and 21 sediments samples during the 1990 SI investigations. Analytical results indicated the presence of hazardous substances at the following maximum concentrations: uranium-234 up to 70,600 picoCuries per kilogram (pCi/kg), uranium-235 up to 28,815 pCi/kg, uranium-238 up to 79,300 pCi/kg, thorium-227 up to 12,100 pCi/kg, thorium-228 up to 9,000 pCi/kg, thorium-230 up to 259,000 pCi/kg, thorium-232 up to 25,800 pCi/kg, arsenic up to 49.7 milligrams per kilogram (mg/kg), barium up to 376 mg/kg, chromium up to 9.9 mg/kg, lead up to 39.2 mg/kg, selenium up to 254 mg/kg, and vanadium up to 5,660 mg/kg. A laboratory quality control (QC) sample for the soil/sediment samples was not analyzed; therefore, the data did not meet CLP criteria, and it was qualified as provisional (2, 3).

### **3.1.2 Surface Water Sampling**

The NSP collected a total of 11 surface water samples during the 1990 SI investigations. Analytical results indicated the presence of hazardous substances at the following maximum concentrations: uranium-234 up to 25 picoCuries per liter (pCi/l), uranium-235 up to 12.8 pCi/l, uranium-238 up to 26.1 pCi/l, thorium-227 up to 0.7 pCi/l, thorium-228 up to 0.40 pCi/l, thorium-230 up to 7.71 pCi/l, thorium-232 up to 0.30 pCi/l, arsenic up to 7.8 micrograms per liter (µg/l), barium up to 121 µg/l, lead up to 50.6 µg/l, selenium up to 22.0 µg/l, and vanadium up to 183 µg/l (2, 3).

### **3.1.3 Groundwater**

The NSP collected a total of 10 groundwater during the 1990 SI Investigations. Analytical results indicated the presence of hazardous substances at the following maximum concentrations: uranium-234 up to 9.4 pCi/l, uranium-235 up to 11.58 pCi/l, uranium-238 up to 11.89 pCi/l, thorium-228 up to 0.32 pCi/l, thorium-230 up to 0.59 pCi/l, arsenic up to 3.0 µg/l, barium up to 158 µg/l, lead up to 4.7 µg/l, selenium up to 3.3 µg/l, and vanadium up to 42.6 µg/l (2,3).

## **3.2 U.S. Environmental Protection Agency – 1994 Sampling**

In June 1994, the EPA directed Bechtel Environmental, Inc. (BEI) to collect soil, sediment, surface water and groundwater samples at the KTM Site as part of an ESI. All samples were analyzed for CLP RAS metals. Additionally, the samples were analyzed for isotopic uranium and thorium by EPA Method 907.0 using alpha spectroscopy, and for radium by EPA Methods 903.0 and 904.0. These are drinking water methods; therefore, the soil and sediment samples were solubilized prior to analysis. The National Air and Radiation Environmental Laboratory (NAREL) conducted the radiochemical analyses.

### **3.2.1 Soil/Sediment Sampling**

As part of the 1994 ESI, BEI collected 30 soil samples from source areas, residential areas (within 200 feet of a residence), and from background areas. Analytical results indicated the presence of hazardous substances at the following maximum concentrations: arsenic up to 118 mg/kg, lead up to 44.3 mg/kg, and vanadium up to 5,100 mg/kg. Analytical results of soil samples collected from background locations indicated the presence of arsenic up to 9.9 mg/kg, lead up to 7.5 mg/kg, and vanadium up to 67.3 mg/kg (2).

In addition to the soil samples, BEI collected sediment samples from 35 locations along Oak Springs Wash. Four areas along Oak Springs Wash, with separate upstream and downstream sampling locations, indicated the presence of hazardous substances. Analytical results from the upper portion of Oak Springs Wash indicated the presence of chromium up to 74.2 mg/kg, nickel up to 40.1 mg/kg, and zinc up to 347 mg/kg. Analytical results of samples collected upgradient of the upper portion of Oak Springs Wash indicated the presence of chromium up to 5 mg/kg, nickel was not detected above the detection limit, and zinc up to 24.1 mg/kg. Analytical results from the upper/lower portion of Oak Springs Wash indicated the presence of manganese up to 402 mg/kg. Analytical results of samples collected upgradient from this location indicated the presence of manganese up to 99.7 mg/kg. Analytical results of samples collected from the lower/upper portion of Oak Springs Wash indicated the presence of nickel up to 31 mg/kg. Nickel was not detected above the detection limit upstream of this area. Analytical results from the lower portion of Oak Springs Wash indicated the presence of vanadium up to 82.6 mg/kg. Vanadium was detected at 10.5 mg/kg upstream of this location (2).

Analytical results of sediment samples collected downstream of mining activities indicated the presence of thorium-227 up to  $0.835 \pm 0.333$  pCi/g, thorium-230 up to  $12.0 \pm 0.928$  pCi/g, uranium-234 up to  $8.50 \pm 0.881$  pCi/g, uranium-235 up to  $0.398 \pm 0.174$  pCi/g, and uranium-238 up to  $9.10 \pm 0.918$  pCi/g. Analytical results from upgradient sediment samples indicated the presence of thorium-227 up to  $0.144 \pm 0.0662$  pCi/g, thorium-230 up to  $1.50 \pm 0.145$  pCi/g, uranium-234 up to  $1.16 \pm 0.167$  pCi/g, uranium-235 up to  $0.0935 \pm 0.0435$  pCi/g, and uranium-238 up to  $1.36 \pm 0.184$  pCi/g (2).

### **3.2.2 Surface Water Sampling**

Eighteen surface water samples were proposed for the 1994 ESI, but eight could not be collected because the creek above Oak Springs was dry, and Red Wash was dry. Analytical results of surface water samples, which were collected from Oak Springs Wash downstream of mining operations, did not indicate the presence of hazardous substances at concentrations significantly above background levels (For HRS purposes, an analyte is considered to be present at a concentration significantly above background if one of the following two criteria is met: 1) the analyte is detected in the site-related sample when not detected in the background samples or 2) the analyte is reported at concentrations equal to or greater than three times the maximum background level when detected in the background sample) (2).

### **3.2.3 Groundwater Sampling**

Analytical results of groundwater samples collected from 10 onsite wells or springs during the 1994 ESI did not indicate the presence of hazardous substances at concentrations significantly above background levels. However, two analytes were detected in upgradient locations at concentrations greater than maximum contaminant levels (MCLs). Antimony was detected at concentrations up to 88 µg/l compared to an MCL of 6 µg/l, and beryllium was detected up to 68.7 µg/l compared to an MCL of 4 µg/l (2).

### **3.3 Navajo Superfund Program – 2004 Sampling**

In April 2004, the NSP completed a sampling effort at the KTM Site as part of an on-going SI Reassessment. According to the draft report, the NSP collected a total of nine soil samples, 15 sediment samples, five surface water samples, and eight groundwater samples. Figure 3-1a shows the sampling locations for all sample mediums. Figure 3-1b shows sample locations where concentrations of metals and radionuclides were detected at concentrations significantly above background levels. All samples were analyzed by CLP laboratories for Target Analyte List metals using EPA Method ILM04.1. Additionally, soil and sediment samples were analyzed for lead-210, radium-226, radium-228, isotopic uranium, and isotopic thorium by NAREL. NAREL analyzed the surface water and groundwater samples for radium-226, radium-228, isotopic uranium, and isotopic thorium. The data were validated by the EPA Region 9 Quality Assurance Office (3, Appendix D).

#### **3.3.1 Soil Sampling**

According to the 2004 draft report, the NSP collected background soil samples from three locations that were not disturbed by operational activities and six samples from five separate AUM sites reclaimed by the NAMLRP: Oak Springs Mine, King Tutt Point, VCA Plot 7 Mines, VCA Plot 3, and Begay No. 1. Soil sample results are shown in Table 3-1. Bold underlined values indicate concentrations that are significantly above background levels, as defined above. Additionally, a radionuclide is considered to be significantly above background if the analyte is equal to or exceeds two standard deviations above the mean background concentration (3, Appendix D).

According to the draft report, analytical results of the soil samples indicated the presence metals, including lead up to 26.5 mg/kg, mercury up to 0.77 mg/kg, selenium up to 9.8 mg/kg, and vanadium up to 2,870 mg/kg. Analytical results of soil samples from background locations indicated the presence of lead up to 7.9 mg/kg, mercury up to 0.11 mg/kg, selenium up to 3.9 mg/kg, and vanadium up to 37.7 mg/kg. A soil sample, SS-2, collected at Oak Springs Mine contained lead, mercury, vanadium, and selenium at concentrations significantly above background. Vanadium was detected at concentrations significantly above background in samples SS-2, SS-4, SS-5, SS-6, and SS-9. The samples with concentrations of vanadium significantly above background were collected from four of the five reclaimed AUM sites: Oak Springs Mine, VCA Plot 7 Mines, VCA Plot 3, and Begay No. 1. Selenium was detected at a concentration significantly above background in sample SS-9 at Begay No. 1 (3, Appendix D).

According to the draft report, analytical results of the soil samples indicated the presence of radionuclides, including lead-210 up to 57.5 pCi/g, thorium-228 up to 5.21 pCi/g, thorium-230 up to 152 pCi/g, radium-226 up to 206 pCi/g, uranium-234 up to 130 pCi/g, uranium-235 up to 10.3 pCi/g, and uranium-238 up to 138 pCi/g. Analytical results of soil samples from background locations indicated the presence lead-210 up to 4.7 pCi/g, thorium-230 up to 1.75 pCi/g, radium-226 up to 2.86 pCi/g, uranium-234 up to 1.17 pCi/g, and uranium-238 up to 1.14 pCi/g. Uranium-235 was not detected in any of the background samples. Radium-226, thorium-230, uranium-234, and uranium-235 were detected at concentrations significantly above background in all soil samples collected at all five reclaimed AUM sites in samples SS-2, SS-4, SS-5, SS-6, SS-8, and SS-9. Lead-210 was detected at concentrations significantly above background in samples SS-2, SS-8, and SS-9, which were collected at the Oak Springs Mine, King Tutt Point, and Begay No. 1 mines, respectively (3, Appendix D).

### **3.3.2 Sediment Sampling**

According to the 2004 draft report, the NSP collected background sediment samples from three off-site background locations that had not been disturbed by operational activities as well as samples from 12 downstream or adjacent surface drainages. Sediment samples were collected from 0 to 6 inches below ground surface. Sediment sample results are shown in Table 3-2 (3, Appendix D).

According to the draft report, analytical results of the sediment samples indicated the presence of metals, including aluminum up to 17,900 mg/kg, arsenic up to 87.2 mg/kg, barium up to 1,070 mg/kg, beryllium up to 0.95 mg/kg, chromium up to 242 mg/kg, cobalt up to 33.3 mg/kg, copper up to 41.4 mg/kg, iron up to 32,300 mg/kg, magnesium up to 31,600 mg/kg, nickel up to 178 mg/kg, potassium up to 3,020 mg/kg, sodium up to 2,360 mg/kg, and vanadium up to 239 mg/kg. Analytical results of sediment samples from background locations indicated the presence of aluminum up to 4,080 mg/kg, arsenic up to 1.4 mg/kg, barium up to 1.71 mg/kg, chromium up to 2.3 mg/kg, cobalt up to 2.5 mg/kg, copper up to 7.5 mg/kg, iron up to 4,260 mg/kg, magnesium up to 3,190 mg/kg, nickel up to 3.7 mg/kg, potassium up to 977 mg/kg, sodium up to 219 mg/kg, and vanadium up to 8.3 mg/kg. The majority of metals detected at concentrations significantly above background levels were detected in sediment sample SD-2 that was collected downstream of the Oak Springs Mine. Arsenic, chromium, nickel, and vanadium were detected in multiple samples at concentrations significantly above background in samples SD-2, SD-7, SD-10, SD-11, which were collected downstream of the Franks Point, Upper Salt Rock, Lower Salt Rock, and VCA Plot 7 Mines. Arsenic, nickel, and vanadium were detected at concentrations significantly above background in sample SD-6, which was collected at the VCA Plot 7 Mines. Arsenic, chromium, nickel, and silver were detected at concentrations significantly above background in sample SD-9, which was collected downstream of a large portion of the KTM site. Vanadium was detected at a concentration significantly above background in sediment sample SD-13, which was collected downstream of the Nelson Point, Oak 143, Oak 146, Oak 156, Shadyside Incline, Tent No. 1, and VCA Plot 3 mines (3, Appendix D).

According to the draft report, analytical results of the sediment samples indicated the presence of radionuclides, including lead-210 up to 4.84 pCi/g, radium-226 up to 15.1 pCi/g, radium-228 up to 2.75 pCi/g, thorium-227 up to 0.584 pCi/g, thorium-228 up to 2.6 pCi/g, thorium-230 up to 12.7 pCi/g, thorium-232 up to 2.35 pCi/g, uranium-234 up to 10.4 pCi/g, uranium-235 up to 0.904 pCi/g, and uranium-238 up to 8.77 pCi/g. Analytical results of sediment samples from background locations indicated the presence of radium-226 up to 1.51 pCi/g, radium-228 up to 0.575 pCi/g, thorium-228 up to 0.343 pCi/g, thorium-230 up to 0.798 pCi/g, thorium-232 up to 0.44 pCi/g, uranium-234 up to 0.775 pCi/g, uranium-235 up to 0.0946 pCi/g, and uranium-238 up to 0.634 pCi/g. Lead-210 and thorium-227 were not detected in the background samples. The majority of radionuclides detected at concentrations significantly above background were detected in sediment sample SD-2, which was collected downstream of the Oak Springs Mine. However, radium-226, thorium-230, uranium-234, uranium-235, and uranium-238 were detected at concentrations significantly above background in the majority of samples (SD-6, SD-7, SD-9, SD-10, SD-11, SD-13, and SD-14) collected downstream of the mine sites. Thorium-228 was detected at concentrations significantly above background in samples SD-3, SD-4, SD-7, SD-8, SD-9, SD-10, SD-11, SD-13, SD-14, and SD-15. Thorium-232 was detected at concentrations significantly above background in samples SD-10 and SD-11 (3, Appendix D).

### **3.3.3 Surface Water Sampling**

According to the 2004 draft report, the NSP collected a background surface water sample at one location upgradient of the KTM Site. The background location was collected at a pipe outlet that conveyed spring water out of the side of a wash. In addition, four surface water samples were collected downgradient of the KTM Site. Due to the fact that only one background sample was collected, a standard deviation value for the radionuclides could not be calculated. Therefore, radionuclide concentrations that are two times above background levels are considered to be significantly above background. Surface water sample results are shown in Table 3-3 (3, Appendix D).

According to the draft report, analytical results of the surface water samples indicated the presence metals, including iron up to 92.2 µg/l, manganese up to 36.7 µg/l, sodium up to 318,000 µg/l, and vanadium up to 19.4 µg/l. Analytical results of the surface water sample from the background location indicated the presence of iron up to 24.6 µg/l, sodium up to 21,200 µg/l, and vanadium up to 5.7 µg/l. Manganese was not detected in the background sample. Iron was detected at a concentration significantly above background in one sample, SW-5, which was located downstream of the Begay No. 1 mine. Manganese was detected at concentrations significantly above background in sample SW-2, downstream of the Oak Springs Mine, and in sample SW-5. Sodium was detected in sample SW-4, located in the Oak Springs Wash below the Salt Canyon Mines, and in sample SW-5. In addition, vanadium was detected at a concentration significantly above background in sample SW-4 (3, Appendix D).

According to the draft report, analytical results of the surface water samples indicated the presence of radionuclides, including radium-226 up to 0.959 pCi/l, uranium-234 up to 26.6 pCi/l, uranium-235 up to 1.96 pCi/l, and uranium-238 up to 22.5 pCi/l. Analytical results of the surface water sample from

the background location indicated the presence of uranium-234 up to 1.69 pCi/l, uranium-235 up to 0.0943 pCi/l, and uranium-238 up to 0.906 pCi/l. Radium-226 was not detected in the background sample. Surface water sample SW-4, located down gradient to the majority of the KTM Site contained radium-226, uranium-234, uranium-235, and uranium-238 at concentrations significantly above background levels as well as the highest concentrations of these analytes. Additionally, surface water sample SW-5 contained uranium-234, uranium-235, and uranium-238 at concentrations significantly above background (3, Appendix D).

### **3.3.4 Groundwater Sampling**

According to the 2004 draft report, the NSP collected a background groundwater sample at one location from a water source that is hydraulically upgradient of the KTM Site and seven samples hydraulically downgradient of the KTM Site. Due to the fact that only one background sample was collected, a standard deviation value for the radionuclides could not be calculated. Therefore, radionuclide concentrations that are two times above background levels are considered to be significantly above background. Groundwater sample results are shown in Table 3-4 (3, Appendix D).

According to the draft report, analytical results of the groundwater samples indicated the presence metals, including iron up to 791 µg/l, magnesium up to 39,400 µg/l, manganese up to 161 µg/l, sodium up to 216,000 µg/l, vanadium up to 69.1 µg/l, and zinc up to 144 µg/l. Analytical results of the groundwater sample from the background location indicated the presence magnesium up to 11,600 µg/l, manganese up to 0.55 µg/l, sodium up to 15,000 µg/l, vanadium up to 4.1 µg/l, and zinc up to 13.9 µg/l. Iron was not detected in the background sample. Five groundwater samples contained metals at concentrations significantly above background levels. Sample GW-4 contained concentrations of iron, magnesium, manganese, sodium, vanadium, and zinc. Sample GW-5 contained concentrations of manganese, sodium, and vanadium. Sample GW-6 contained concentrations of manganese. Samples GW-7 and GW-8 contained concentrations of manganese and zinc. There are no MCLs for any of the metals that we detected at concentrations that were significantly above background in these groundwater samples (3, 10, Appendix D).

According to the draft report, only one groundwater sample, GW-5 contained radionuclide concentrations significantly above background levels. Analytical results indicated the presence of radionuclides, including radium-226 up to 1.49 pCi/l, thorium-230 up to 0.252 pCi/l, uranium-234 up to 10.7 pCi/l, uranium-235 up to 0.541 pCi/l, and uranium-238 up to 9.71. Analytical results of the groundwater sample from the background location indicated the presence of uranium-234 up to 1.31 pCi/l, uranium-235 up to 0.086 pCi/l, and uranium-238 up to 0.641 pCi/l. Radium-226 and thorium-230 were not detected in the background sample. None of the radionuclide results exceeded MCLs. In addition, the community of Oak Springs does not rely on local groundwater as a drinking water source. The community is serviced by a connection to the Hidden Springs well, which is located in Cove, Arizona, approximately 15 miles southwest of the KTM Site (3, 10, Appendix D, CR-2).

### **3.4 U.S. Environmental Protection Agency – 2008 Gamma Radiation Survey**

In July 2008, under the EPA direction, WESTON performed a gamma radiation screening survey at the KTM Site as part of the Reassessment. WESTON collected gamma radiation measurements throughout the site using a combination sodium-iodide scintillation detector and a global positioning system (GPS) unit. A stand-alone scintillation detector was used as well. The gamma survey equipment consisted of a Ludlum Model 2221 Scaler/Ratemeter and a Ludlum Model 44-10 Gamma Scintillator, which is a 2 inch by 2 inch sodium-iodide gamma radiation detector. The Ludlum instruments were connected to a Trimble GPS system to provide coordinates for the gamma measurements. The gamma radiation measurements that WESTON collected were recorded in counts per minute (cpm), which can be approximated as  $\mu\text{R/hr}$  by dividing by 1,000 (Appendix B).

In addition to the above definitions, the HRS considers gamma radiation exposure measurements to be significantly above background levels if they are equal to or exceed two times the site-specific background levels. Background radiation measurements were collected to the south of the Begay No. 1 Mine, in an area that appeared to be undisturbed by mining activities. The average background gamma radiation level was 11,148 cpm. WESTON collected gamma radiation measurements at the KTM Site mines that could be identified at the time of the site reconnaissance. Figures 3-2a through 3-2d show the gamma measurements that were detected at levels significantly above background. As shown in these figures, WESTON detected gamma radiation at levels significantly above background at all of the mines that were surveyed, with the exception of the Shadyside No. 1 Mine. However, a majority of the areas that were surveyed indicated gamma radiation measurements that were less than two times the background levels (11, Appendix B).

As shown in Figures 3-3a through 3-3d, gamma radiation measurements indicated levels that exceeded the NAML RP reclamation goal of 50  $\mu\text{R/hr}$  at specific localized areas within the boundaries of several of the surveyed mines. WESTON identified an eroded section of a cap at the VCA Plot 7 Mines, as shown in Figure 3-3b and Appendix B. Measurements in excess of 100,000 cpm were collected in the small erosion channel in the cap, which was approximately 2 feet deep and 20 feet in length. As shown in Figure 3-3c, two areas with measurements above 50  $\mu\text{R/hr}$  were identified in a natural drainage channel that extends from the northeast corner of Nelson Point Mine through the western perimeter of Tent Mine. The NAML RP reclamation goal was exceeded in a section of NA-0821 as well as a section of NA-0806 where the cap has subsided. However, the portion of the cap at NA-0806 that has subsided was previously identified by NAML RP for future maintenance, and the subsided area is currently fenced off. In addition, measurements above 100,000 cpm were detected at the entrance of a sealed portal located on the border of the Look Point Incline Mine and the Stripped Area 1 of VCA Plot 3. Although the NAML RP reclamation goal of 50  $\mu\text{R/hr}$  was exceeded at certain localized areas, radiation measurements collected by WESTON indicate that the reclamation goal was met in a vast majority of the areas that were surveyed (Appendix B).

### **3.5 U.S. Environmental Protection Agency – 2010 Gamma Radiation Survey**

In June 2010, under the EPA direction, WESTON returned to the KTM Site to conduct a more comprehensive gamma radiation survey. Following the 2008 KTM Site gamma radiation survey,

WESTON acquired more detailed information pertaining to the locations and accessibility of all of the sites within the KTM Site boundary. Of the 41 individual mine sites within the KTM Site boundary, it was determined that 32 warranted further screening. As part of the site screenings, new gamma radiation measurements, additional site reconnaissance and further documentation took place at each of the 32 mine sites. The sites not screened during the 2010 survey were determined to have been significantly covered during the 2008 survey. The 2010 screening included 20 of the 28 mine sites which comprised the 16 KTM Sites. The nine mine sites not screened during the 2010 survey included eight KTM Sites: one of Begay No.1 sites, Nelson Point, Shadyside Incline, Shadyside No.1, Tent No.1, two of the VCA Plot 3 sites, and one of the VCA Plot 7 sites; and included one mine site within the KTM Site boundary but is not found within the 16 sites from the KTM Site list: Oak Springs Mine.

Attachment A shows the gamma radiation measurements and documentation for each of the 32 revisited sites. Figures A-1 through A-46 from Attachment A show the gamma radiation measurements from each of the sites as compared to background levels, and as total cpm. As shown in these figures, WESTON detected gamma radiation at levels significantly above background at nearly all of the mines that were surveyed, with the exception of the NA-0828 mine, one of the Salt Canyon mines, and one of the VCA Plot 7 mines. In some cases, gamma radiation measurements were collected at levels above 300,000 cpm. However, a majority of the areas that were surveyed indicated gamma radiation measurements that were less than two times the background levels. Unreclaimed waste piles were also observed at nearly half of the surveyed mines. Although the NAMLRP reclamation goal of 50  $\mu$ R/hr was exceeded at certain localized areas, radiation measurements collected by WESTON during the 2010 survey indicate that the reclamation goal was met in a vast majority of the areas that were surveyed (Attachment A).

#### **4.0 EMERGENCY RESPONSE CONSIDERATIONS**

The National Contingency Plan [40CFR 300.415 (b) (2)] authorizes the EPA to consider emergency response actions at those sites that pose an imminent and substantial threat to human health or the environment. For the following reasons, a referral to Region 9's Emergency Response Office does not appear to be necessary:

- Hazardous substances associated with the site are located in an area of rugged terrain with a sparse surrounding population.
- According to a draft SI report, recent groundwater samples collected during a 2004 sampling event did not indicate concentrations of hazardous substances above MCLs. In addition, the local community receives its drinking water from a connection to a well that is located approximately 15 miles from the site.
- The NAMLRP has conducted reclamation work throughout the site. Gamma radiation survey conducted in 2008 and 2010 indicate that while elevated gamma radiation measurements were found in certain localized areas, reclamation goals were met in a majority of the areas that were surveyed.

## **5.0 SUMMARY**

The KTM Site occupies approximately 3,500 acres in a sparsely populated rural area near the community of Oak Springs, which is in the Red Valley Chapter of the Navajo Nation. The site consists of 16 sites comprised of 28 individual mine site, which are being evaluated as a single, aggregate site. The sites are located in an area of rugged terrain that is accessible via dirt roads. There are approximately 200 individual mine features, such as portals, prospects, rim strips, and vertical shafts that are located throughout the 16 sites.

The KTM Site is located on land held in trust for the Navajo Nation by the U.S. Department of Interior, Bureau of Indian Affairs. Several companies operated uranium mine claims throughout the site from the early 1940's to the late 1960's; however, the former Vanadium Corporation of America operated a majority of the mines. Portals, rim strips, and vertical shafts were used to obtain ore from the site. Operations at the site consisted of conventional blasting techniques combined with manual labor to remove overburden and ore. Navajo workers manually sorted the higher grade uranium and vanadium ore into piles that were transported to off-site mills. Lower grade ore and overburden remained on site in waste piles near the mine workings, on steep slopes, and in surface drainages.

In 1992, the Navajo Abandoned Mine Lands Reclamation Program (NAMLRP) began conducting reclamation work at individual mine sites located within the KTM Site boundary. Reclamation activities conducted by the NAMLRP included backfilling portals, prospects, and rim strips with radioactive mine waste (lower grade uranium ore) that remained on the sites. Non-contaminated soil was used as cap in several areas. Additionally, the NAMLRP closed certain areas with polyurethane foam plugs, diverted drainage from the backfilled areas, and seeded areas for re-vegetation. Much of the work was conducted through contracts with local construction companies. By 2002, the NAMLRP completed reclamation activities at the KTM Site. Each of the 16 sites that comprise the KTM Site were reclaimed by the NAMLRP, with the exception of mine site Oak 156, which is part of the Navajo - VCA Plot 3 site. As recently as 2006, the NAMLRP conducted maintenance at the KTM Site to address erosion and other issues impacting the reclamation work (3, 4, 5, 8, 9).

Numerous investigations have been conducted throughout the KTM Site. The Navajo Nation Environmental Protection Agency, Navajo Superfund Program (NSP) conducted Preliminary Assessments on the 16 sites during 1989 and 1990. In 1991 and 1992, the NSP conducted four sampling Site Inspections (SIs) and eight non-sampling SIs at sites that comprise the aggregate KTM Site. In 1994, the U.S. Environmental Protection Agency (EPA) conducted a sampling event at the site as part of an ESI, which was completed in 1996. Again in 2004, the NSP conducted an additional sampling event at the KTM Site as part of an on-going SI Reassessment. In support of the on-going SI Reassessment, the EPA performed gamma radiation screening surveys in 2008 and 2010 at all of the mine sites within the KTM Site boundary.

The following pertinent Hazard Ranking System (HRS) factors are associated with the site:

- Analytical results of previous investigations indicate the presence of hazardous substance, including metals and radionuclides, in on-site soil samples and off-site sediment, surface

water, and groundwater samples.

- Gamma radiation measurements collected in 2008 and 2010 detected levels significantly above background at nearly all of the mine sites. However, a majority of the areas that were surveyed indicated gamma radiation measurements that were less than two times the background levels. In addition, reclamation has been conducted at all of the mines that comprise the KTM Site. With the exception of certain localized areas, reclamation goals were met at a majority of the surveyed areas.
- According to a draft report, recent groundwater samples collected during a 2004 sampling event did not indicate concentrations of hazardous substances above MCLs. In addition, the local community receives its drinking water from a connection to a well that is located approximately 15 miles from the site.
- There are no residences, schools, or daycare facilities within 200 feet of the AUM sites.

## **6.0 REFERENCE LIST**

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2. Bechtel Environmental, Inc., Expanded Site Inspection, King Tutt Mesa Aggregate Site, Oak Springs, New Mexico, March 14, 1996
3. Navajo Superfund Program, Draft Site Inspection Report, King Tutt Mesa Aggregate Site, Red Rock, Apache County, Arizona, November 18, 2004.
4. TerraSpectra Geomatics, Abandoned Uranium Mines (AUM) and the Navajo Nation, Northern AUM Region Draft Screening Assessment Report, March 2006
5. TerraSpectra Geomatics, Abandoned Uranium Mines and the Navajo Nation, Navajo Nation AUM Screening Assessment Report and Atlas with Geospatial Data, August 2007.
6. Google Earth, Satellite Image, 2008.
7. EPA, Envirofacts Warehouse, RCRAinfo Query Results, [http://oaspub.epa.gov/enviro/fii\\_master.fii\\_retrieve?fac\\_search=primary\\_name&fac\\_value=](http://oaspub.epa.gov/enviro/fii_master.fii_retrieve?fac_search=primary_name&fac_value=), based on data extracted June 8, 2006.
8. The Navajo Nation, Navajo Abandoned Mine Lands Reclamation Program, Proposal Documents, Oakspring 4; Phase II AML Reclamation Project, Oakspring, Arizona, January, 2001.
9. Navajo Abandoned Mine Lands Reclamation Program, Maintenance Assessment Report, July 12, 2006
10. EPA, National Primary Drinking Water Regulations, List of Contaminants & their MCLs, <http://www.epa.gov/safewater/contaminants/index.html>, data extracted Sept 10, 2008.
11. EPA, Federal Register, 40 CFR Part 300, Hazard Ranking System; Final Rule, December 14, 1990.

Table 2-1: King Tutt Mesa Site Summary Table											
CERCLA MINE NAME	ALIASES	CERCLA ID	NAMLRP ID	SITE AREA (Square Meters)	MINE FEATURES				TONS OF ORE	POUNDS OF U308	RECLAMATION STATUS
					Portal	Prospect	Rim Strip	Vertical Shaft			
Navajo - Begay Incline Uranium Mine	Begay Incline	NND986675031	NA-0810	17,902	1				655	3,475	Reclaimed by NAMLRP
Navajo - Begay #1 Uranium Mine	Begay No. 1	NND986667517	NA-0812	63,286	1	1		1	3,921	16,491	Reclaimed by NAMLRP
			NA-0807	5,821				1			
Navajo - Begay #2 Uranium Mine	Begay No. 2	NND986667509	NA-0810	24,187	1				4,515	18,455	Reclaimed by NAMLRP
Navajo - Canyon View (Alongo Claim) Uranium	Alongo Mines, Alongo, MP-336	NND986667533	NA-0817	35,125	2	2			27	76	Reclaimed by NAMLRP
Navajo - Carrizo Mine	Carrizo No. 1, Carrizo	NND986667491	NA-0807	3,016	1				828	3,426	Reclaimed by NAMLRP
Navajo - Franks Point/VCA Plot 6 Uranium Mine	East Reservatioon Lease Plot 6, VCA Plot 6, Plot 6	NND986675049	NA-0802, NA-0823	18,405	1		1	1	25	110	Reclaimed by NAMLRP
Navajo - Junction Claim Uranium Mine	Junction	NND986675023	NA-0826	10,778		1	1		18	38	Reclaimed by NAMLRP
Navajo - King Tutt #1 Uranium Mine	King Tutt 1, King Tutt No. 2, MP-6	NND986675080	NA-0816	30,228	1	2	1		290	1,060	Reclaimed by NAMLRP
Navajo - King Tutt Point Uranium Mine	East Reservatioon Lease Plot 2, VCA Plot 2, Plot 2	NND986667434	NA-0811	54,575	8	2	3		1,384	7,260	Reclaimed by NAMLRP
Navajo - Red Wash Point Uranium Mine	East Reservation Lease Plot 1, VCA Plot 1 Mine	NND986667459	NA-0816	50,294	2	2	5		1,158	6,324	Reclaimed by NAMLRP
Navajo - Salt Canyon Mines	George Tutt, MP-4	NND986667467	NA-0819a	29,209	2	2	3		61	231	Reclaimed by NAMLRP
			NA-0819b	6,063			1		0	0	
Navajo - Tent Uranium Mine	Tent No. 1, Tent No. 2 Mine, Tent	NND986667483	NA-0815	19,469	1		1		1,198	5,303	Reclaimed by NAMLRP
Navajo- Upper Salt Rock Uranium Mine	Salt Rock, Upper Salt Rock Canyon Mine, Salt Wash, Upper Salt Wash	NND986667590	NA-0823	5,766			1		96	295	Reclaimed by NAMLRP
Navajo - Vanadium Corporation of America (VCA)	East Reservation Lease Plot 3	NND986667475									
	Lookout Point		NA-0803	28,641	9	1	1		5,839	31,759	Reclaimed by NAMLRP
	Lookout Point Incline		NA-0804	5,136	1		1	1	506	2,714	Reclaimed by NAMLRP
	Nelson Point		NA-0815	20,725	1		1		15,213	74,978	Reclaimed by NAMLRP
	Shadyside Incline		NA-0805	5,903				1	2,401	11,770	Reclaimed by NAMLRP
	Shadyside No. 1		NA-0813	24,857	2				1,510	8,356	Reclaimed by NAMLRP
	VCA Plot 3		Oak156; NA-0806, NA-0808	175,642	2		26		0	0	Reclaimed by NAMLRP, except Oak 156
	VCA Plot 3		NA-0814, NA-0820	75,408	7	3	18				Reclaimed by NAMLRP
	VCA Plot 3		NA-0813	30,118	1		2				Reclaimed by NAMLRP
	VCA Plot 3		NA-0813	40,172	1		1				Reclaimed by NAMLRP
Navajo - VCA Plot 7 Uranium Mine	East Reservation Lease Plot 7; Lower Oak Creek, Canyon View, Sam Point, "297" Mine, "305" Mine, "317" Stope, Lower Oak Creek Mine, Lower Oak Springs	NND986667426	NA-0801	21,681	2	2			4,899	25,958	Reclaimed by NAMLRP
			NA-0818	3,802		1					
			NA-0818	204,271	7	1	27	1			
Navajo- Williams Point Mine	Williams Point, East Reservation Lease Plot 4, Plot 4, VCA Plot	NND986673283	NA-0827	25,502	1		2		127	544	Reclaimed by NAMLRP

Table 2-2: Additional Mines Within the King Tutt Mesa Site Boundary										
MINE NAME	ALIASES	NAMLRP ID	SITE AREA (Square Meters)	MINE FEATURES				TONS OF ORE	POUNDS OF U308	RECLAMATION STATUS
				Portal	Prospect	Rim Strip	Vertical Shaft			
Lower Salt Rock	Salt Rock, MP-69; Lower Salt Rock Canyon Mine, Upper Salt Wash 2; Salt Wash, Lower Salt Wash	NA-0823	2,628			1		10	63	Reclaimed by NAMLRP
NA-0824	N/A	NA-0824	7,349	1		1		0	0	Reclaimed by NAMLRP
NA-0828	N/A	NA-0828	4,102		1			0	0	Reclaimed by NAMLRP
Oak124, Oak125	N/A	Oak124, Oak125	10,560			2		0	0	Unreclaimed by NAMLRP
Oak143, Oak146	N/A	Oak143, Oak146	22,490			2		0	0	Unreclaimed by NAMLRP
Oak230	N/A	Oak230	11,667			1		0	0	Unreclaimed by NAMLRP
Oak238	N/A	Oak238	11,667		1			0	0	Unreclaimed by NAMLRP
Oak Springs Mine	VCA Plot 10, East Reservation Lease Plot 10; Plot #10 VCA, Oak Springs	NA-0808	37,479	3	4			1978	9389	Reclaimed by NAMLRP
Oaks Springs Mine (Gravel Cap)	Oak Spring Mine (Cato Sells), Gravel Top Mine, Oak Spring Mine (Gravel Cap)	NA-0800, NA-0808	48,808	2	2	4		5112	2389	Reclaimed by NAMLRP
Red Rock	Horse Mesa North	NA-0828	4,217			1		22	65	Reclaimed by NAMLRP
Red Wash (Hosteen S. Begay)	N/A	NA-0817	11,775	1				61	127	Reclaimed by NAMLRP
Red Wash (Leroy Pettigrew)	Horse Mesa South	NA-0828	6,129	1				27	137	Reclaimed by NAMLRP
Shadyside No. 2	East Reservation Lease Plot 3, VCA Plot 3	NA-0813	13,692	2		1		2033	11557	Reclaimed by NAMLRP

Table 2-3: King Tutt Mesa Site CERCLIS Summary Table								
CERCLA MINE NAME	ALIASES	CERCLA ID	NPL STATUS	FEDERAL FACILITY	RESPONSIBILITY	ENFORCEMENT / CLEANUP ACTION		
						Action (Most Recent)	Date (Most Recent)	Planned Outcome
Navajo - Begay Incline Uranium Mine	Begay Incline	NND986675031	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
Navajo - Begay #1 Uranium Mine	Begay No. 1	NND986667517	Not Listed	No	State, Fund Financed	Site Inspection	9/27/1991	Low priority for further assessment
Navajo - Begay #2 Uranium Mine	Begay No. 2	NND986667509	Not Listed	No	EPA Fund-Financed	Site Inspection	9/27/1991	Low priority for further assessment
Navajo - Canyon View (Alongo Claim) Uranium	Alongo Mines, Alongo, MP-336	NND986667533	Not Listed	No	State, Fund Financed	Site Inspection	3/31/1992	Low priority for further assessment
Navajo - Carrizo Mine	Carrizo No. 1, Carrizo	NND986667491	Not Listed	No	State, Fund Financed	Site Inspection	3/30/1992	Low priority for further assessment
Navajo - Franks Point/VCA Plot 6 Uranium Mine	East Reservatioon Lease Plot 6, VCA Plot 6, Plot 6	NND986675049	Not Listed	No	State, Fund Financed	Site Inspection	3/30/1992	Low priority for further assessment
Navajo - Junction Claim Uranium Mine	Junction	NND986675023	Not Listed	No	EPA Fund-Financed	Preliminary Assessment	3/1/1990	Low priority for further assessment
Navajo - King Tutt #1 Uranium Mine	King Tutt 1, King Tutt No. 2, MP-6	NND986675080	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
Navajo - King Tutt Point Uranium Mine	East Reservatioon Lease Plot 2, VCA Plot 2, Plot 2	NND986667434	Not Listed	No	EPA Fund-Financed	Expanded Site Inspection	9/29/1997	Recommended for HRS Scoring
Navajo - Red Wash Point Uranium Mine	East Reservation Lease Plot 1, VCA Plot 1 Mine	NND986667459	Not Listed	No	State, Fund Financed	Site Inspection	3/30/1992	Low priority for further assessment
Navajo - Salt Canyon Mines	George Tutt, MP-4	NND986667467	Not Listed	No	State, Fund Financed	Site Inspection	3/30/1992	Low priority for further assessment
Navajo - Tent Uranium Mine	Tent No. 1, Tent No. 2 Mine, Tent	NND986667483						
Navajo- Upper Salt Rock Uranium Mine	Salt Rock, Upper Salt Rock Canyon Mine, Salt Wash, Upper Salt Wash	NND986667590	Not Listed	No	State, Fund Financed	Site Inspection	3/30/1992	Low priority for further assessment
Navajo - Vanadium Corporation of America (VCA)	East Reservation Lease Plot 3	NND986667475	Not Listed	No	State, Fund Financed	Site Inspection	9/25/1991	Low priority for further assessment
	Lookout Point	East Reservation Lease Plot 3, Lookout Point - Sunnyside, Plot 3, Sunnyside, VCA Plot 3						
	Lookout Point Incline	East Reservation Lease Plot 3; Lookout Point West						
	Nelson Point	East Reservation Lease Plot 3, VCA Plot 3						
	Shadyside Incline	East Reservation Lease Plot 3; Shadyside Decline						
	Shadyside No. 1	East Reservation Lease Plot 3, VCA Plot 3						
	VCA Plot 3	East Reservation Lease Plot 3						
	VCA Plot 3	East Reservation Lease Plot 3						
	VCA Plot 3	East Reservation Lease Plot 3						
	VCA Plot 3	East Reservation Lease Plot 3						
Navajo - VCA Plot 7 Uranium Mine	East Reservation Lease Plot 7; Lower Oak Creek, Canyon View, Sam Point, "297" Mine, "305" Mine, "317" Stope, Lower Oak Creek Mine, Lower Oak Springs	NND986667426	Not Listed	No	State, Fund Financed	Site Inspection	9/25/1991	Low priority for further assessment
Navajo- Williams Point Mine	Williams Point, East Reservation Lease Plot 4, Plot 4, VCA Plot	NND986673283	Not Listed	No	State, Fund Financed	Site Inspection	3/30/1992	Low priority for further assessment

**Table 3-1: 2004 Draft SI Reassessment Soil Sampling**

	Background Samples							Release Samples											
Sample ID CLP ID Date	SS-1 MY1B44 4/28/2004		SS-3 MY1B49 4/27/2004		SS-7 MY1B53 4/29/2004		Significantly Above Background	SS-2 MY1B49 4/27/2004		SS-4 MY1B50 4/27/2004		SS-5 MY1B51 4/28/2004		SS-6 MY1B52 4/28/2004		SS-8 MY1B54 4/29/2004		SS-9 MY1B55 4/29/2004	
	Result	Val	Result	Val	Result	Val		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val	Result	Val
Metals (mg/kg)																			
Aluminum	7,020		5,120		10,300		30,900	7,720		5,130		6,260		6,200		8,840		7,680	
Antimony	6.6	U	6.3	U	6.6	U	CRQL (6)	6.3	U	6.1	U	6.2	U	6.2	U	6.2	U	6.3	U
Arsenic	3.6	J	1.5	U	2.3	J	17.3*	6.7	J	4.4	J	4	J	3.2	J	2.1	J	8.8	J
Barium	151		76.3		174		522	230		133		100		99.4		347		72.2	
Beryllium	0.39	J	0.34	J	0.57		1.71	0.52	J	0.31	U	0.28	J	0.29	J	0.5	J	0.36	J
Cadmium	0.05	J	0.53	U	0.55	U	CRQL (0.5)	0.49	J	0.1	J	0.13	J	0.13	J	0.07	J	0.07	J
Calcium	34,300		22,100		22,000		102,900	16,700		42,200		19,900		19,400		45,100		19,800	
Chromium	5.0		2.8		7.8		23.4	3.3		2.4		2.0		2.0		5.9		4.8	
Cobalt	3.5	J	2.6	J	5.6		16.8	7.3		3.3	J	3.2	J	3	J	4.5	J	6	
Copper	6.9		6.9		11.4		34.2	17.9		8.0		6.3		6.4		12.4		15.5	
Iron	6,870		5,010		9,920		29,760	8,170		4,020		4,530		4,410		8,020		7,400	
Lead	6		4.6		7.9		23.7	<b>26.5</b>		8.8		10.6		9.6		6.5		13.4	
Magnesium	4,100		3,440		6,760		20,280	3,560		3,720		3,470		3,420		6,630		5,480	
Manganese	259		170		76.8		777	132		243		126		125		290		136	
Mercury	0.02	J	0.11	U	0.11	U	CRQL (0.1)	<b>0.77</b>	J-	<b>0.12</b>	J-	<b>0.19</b>	J-	<b>0.15</b>	J-	0.02	J	0.1	U
Nickel	5.8		4.1	J	10.9		32.7	7.1		4.9		3.9	J	3.7	J	8.4		8.6	
Potassium	1,230		1,310		2,860		8,580	2,490		1,250		1,310		1,290		2,390		1,690	
Selenium	3.8	U	3.7	U	3.9	U	CRQL (3.5)	<b>4.7</b>		1.4	J	3.6	J	3.2	J	0.59	J	<b>9.8</b>	
Silver	1.1	U	1.1	U	1.1	U	CRQL (1)	0.39	J	1	U	0.22	J	1	U	1	U	1	U
Sodium	214	J	156	J	196	J	6,420*	528	U	125	J	52.8	J	40	J	824		220	J
Thallium	2.7	U	2.6	U	2.8	U	CRQL (2.5)	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
Vanadium	15.8		8.6		37.7		113.1	<b>2,870</b>		<b>1,320</b>		<b>916</b>		<b>897</b>		56		<b>533</b>	
Zinc	22		15.3		30.9		92.7	20		14.6		15.5		13.1		28.2		27.5	
Radionuclides (pCi/g)																			
Radium-226 by Radon Emanation																			
Radium-226	0.816	U	1.34	U	2.06		2.654	<b>132</b>		<b>73.1</b>		<b>42.4</b>		<b>108</b>		<b>4.69</b>		<b>76</b>	
Gamma Spectroscopy by High Purity Lithium Detector																			
Lead-210	1.6	U	1.9	U	4.7	U	MDC	<b>57.5</b>	J	10	U	16	U	15	U	<b>2.82</b>		<b>18.9</b>	J
Radium-226	1.57	J	1.68		2.86		3.467	<b>206</b>	J	<b>103</b>		<b>160</b>		<b>161</b>		<b>3.5</b>		<b>104</b>	J
Radium-228	0.813	J	0.483		1.09		1.403	0.676	J	0.674		0.532		0.398		0.811		0.64	J
Uranium-235	0.0987	J	0.106		NA		0.113	<b>7.34</b>	<b>1</b>	<b>5.15</b>		<b>6.3</b>		<b>6.16</b>		<b>0.356</b>		<b>4.57</b>	J
Uranium and Thorium by Extraction Chromatography/Alpha Spectrometry																			
Uranium-234	0.442		0.716		1.17		1.511	<b>130</b>		<b>96.5</b>		<b>126</b>		<b>111</b>		<b>4.24</b>		<b>97.2</b>	
Uranium-235	0.027	U	0.029	U	0.078	U	MDC	<b>6.79</b>		<b>6.88</b>		<b>10.3</b>		2.1	U	<b>0.171</b>		<b>8.68</b>	
Uranium-238	0.616		1.04		1.14		1.488	<b>134</b>		<b>85.2</b>		<b>138</b>		<b>126</b>		<b>4.54</b>		<b>91.4</b>	
Thorium-227	0.049	U	0.045	U	0.299		0.422	4.4	U	2	U	3.4	U	4.2	U	0.332		2	U
Thorium-228	0.73		0.545		1.11		1.371	3.5	U	2	U	<b>4.93</b>		3.2	U	0.924		<b>5.21</b>	
Thorium-230	0.633		0.893		1.75		2.261	<b>152</b>		<b>104</b>		<b>131</b>		<b>120</b>		<b>3.62</b>		<b>55.3</b>	
Thorium-232	0.562		0.418		0.878		1.090	1.9	U	2.3	U	1.6	U	1.7	U	0.849		2.2	U

CRQL: Contract Required Quantitation Limit. Number in parentheses is CRQL.

MDC: Minimum Detectable Concentration

\*: Value adjusted in accordance with EPA 540-F-94-028.

U: Analyte not detected.

J: Data are estimated.

**Bold:** Bold and underlined data are significantly above background.

**Table 3-2: 2004 Draft SI Reassessment Sediment Sampling**

Sample ID CLP ID Date	Background Samples						Release Samples																												
	SD-1 MY1B32 4/26/2004		SD-5 MY1B42 4/27/2004		SD-12 MY1B35 4/29/2004		Significantly Above Background	SD-2 MY1B39 4/27/2004		SD-3 MY1B40 4/27/2004		SD-4 MY1B42 4/27/2004		SD-6 MY1B43 4/27/2004		SD-7 MY1B44 4/28/2004		SD-8 MY1B45 4/28/2004		SD-9 MY1B46 4/28/2004		SD-10 MY1B33 4/28/2004		SD-11 MY1B34 4/28/2004		SD-13 MY1B36 4/29/2004		SD-14 MY1B37 4/28/2004		SD-15 MY1B38 4/29/2004					
	Result	Val	Result	Val	Result	Val		Result	Val	Result	Val	Result	Val	Result	Val	Result	Val	Result	Val	Result	Val	Result	Val	Result	Val	Result	Val	Result	Val	Result	Val	Result	Val		
Metals (mg/kg)																																			
Aluminum	4,080		1,330		1,130		12,240	<u>17,900</u>		2,040		4,110		2,670		3,090		3,240		3,580		6,500		5,920		3,030		3,810		2,710					
Antimony	6.6	U	0.38	J	6.3	U	CRQL (6)	7.9	U	6.1	U	7.1	U	6.2	U	6.4	U	7.1	U	6.6	U	6.4	U	6.5	U	6.4	U	6.3	U	6.4	U				
Arsenic	1.4	U	0.54	U	1.1	U	CRQL (1)	<u>87.2</u>		0.61	U	0.73	U	<u>3.7</u>		<u>2.4</u>	J	<u>5</u>	J	<u>2.2</u>	J	<u>32.1</u>		<u>3.4</u>		1.6	U	1.1	U	1.5	U				
Barium	171		62.4		41.7		513	<u>1,070</u>		90.6		152		87.1		274		181		151		254		242		66.3		45.1		43.5					
Beryllium	0.3	J	0.09	J	0.06	J	CRQL (0.5)	<u>0.95</u>		0.11	J	0.22	J	0.16	J	0.19	U	0.15	J	0.16	J	0.24	J	0.2	J	0.19	J	0.21	J	0.13	J				
Cadmium	0.11	U	0.03	U	0.06	U	CRQL (0.5)	0.22	U	0.05	U	0.06	U	0.06	U	0.53	U	0.59	U	0.55	U	0.11	U	0.1	U	0.11	U	0.05	U	0.06	U				
Calcium	56,000		13,500		19,700		168,000	44,100		25,500		22,200		22,700		33,300		37,300		30,500		21,800		19,300		37,100		30,100		18,800					
Chromium	2.3		0.77	J	0.84	J	6.9	<u>242</u>	J**	3		3.6		4.9		<u>6.9</u>		6.7		<u>13.3</u>		<u>18.8</u>		<u>16.8</u>		2.3		2		2.6					
Cobalt	2.5	J	0.75	J	0.47	J	CRQL (5)	<u>33.3</u>	J	1.6	J	1.9	J	2	J	2.9	J	<u>3.4</u>	J	4.4	J	<u>8.4</u>		<u>8.4</u>		1.8	J	1.7	J	1.8	J				
Copper	7.5		2.1	J	1.4	J	<u>22.8</u>	<u>41.4</u>	J**	3		2.8	J	5		6.7		5.5		7.5		14.7		14.6		4.7		3.6		2.8					
Iron	4,260		1,250		756		12,780	<u>32,300</u>		2,250		3,080		3,290		6,070		5,550		6,080		11,500		9,630		3,130		2,480		3,480					
Lead	7.6		1.8		1.1		22.8	6.6		3		2.4		3.6		3.7		2.6		2.6		3.9		4.4		3.4		2.4		3					
Magnesium	3,190		826		777		9,570	<u>31,600</u>		1,820		4,410		2,660		3,650		3,800		5,130		<u>10,500</u>		<u>10,300</u>		2,290		4,060		2,760					
Manganese	228	J	166	J	125	J	820.8*	781	J	186	J	177	J	197	J	230		292		279		235	J	227	J	224	J	261	J	207	J				
Mercury	0.11	U	6.1	U	0.11	U	CRQL (0.1)	0.03	J-	6.1	U	0.12	U	0.1	U	0.11	U	0.12	U	0.11	U	0.11	U	0.11	U	0.11	U	0.11	U	0.11	U				
Nickel	3.9	J	0.99	J	1.3	J	CRQL (4)	<u>178</u>		3.3	J	3.3	J	<u>7.1</u>		<u>9.3</u>		<u>10.6</u>		<u>18.5</u>		<u>49.3</u>		<u>50.7</u>		3.9	J	3	J	3.7	J				
Potassium	977		378	J	429	J	2,931	<u>3,020</u>		538		778		784		919		769		995		1,440		1,490		950		829		472	J				
Selenium	3.9	U	3.6	U	3.7	U	CRQL (3.5)	4.6	U	3.6	U	4.2	U	3.6	U	3.7	U	4.1	U	3.8	U	3.8	U	3.8	U	3.7	U	3.7	U	3.7	U				
Silver	1.1	U	1	U	1.1	U	CRQL (1)	1.3	U	1	U	1.2	U	1	U	1.1	U	1.2	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U	1.1	U				
Sodium	219	J	146	J	122	J	CRQL (500)	1,700	J	124	J	195	J	198	J	372	J	<u>629</u>		<u>954</u>		2,360	J	1,910	J	174	J	226	J	344	J				
Thallium	2.8	U	2.6	U	2.6	U	CRQL (2.5)	3.3	U	2.5	U	3	U	2.6	U	2.7	U	3	U	2.7	U	2.7	U	2.7	U	2.6	U	2.6	U	2.7	U				
Vanadium	8.3		3.2	J	5	J	24.9	<u>239</u>	J**	11.5		8.8		<u>112</u>		<u>45.1</u>		<u>81.2</u>		20		<u>75.1</u>		<u>171</u>		<u>53.4</u>		11.2		9					
Zinc	15.5	J	6.6	J	7.1	J	60.45*	52.1	J	9.5	J	30.5	J	11.7	J	16.2		18.5		13.8		20.6	J	21.3	J	13.9	J	13.5	J	16.2	J				
Radionuclides (pCi/g)																																			
Radium-226 by Radon Emanation																																			
Radium-226	0.906	U	0.597	U	0.629	U	MDC	<u>10.5</u>		0.882	U	0.845	U	<u>6.65</u>		1.61	U	2.47	U	0.813	U	1.56	U	1.48	U	1.89	U	1.23	U	0.827	U				
Radium-228 by Gas Proportional Counting																																			
Radium-228	1.8	U	2	U	1.6	U	MDC	<u>2.73</u>		1.9	U	1.8	U	1.9	U	1.8	U	1.8	U	1.6	U	1.6	U	1.6	U	1.7	U	1.8	U	1.7	U				
Gamma Spectroscopy by High Purity Lithium Detector																																			
Lead-210	2.2	U	2.3	U	1.4	U	MDC	<u>4.84</u>	J	3.7	U	2.5	U	<u>2.72</u>	J	2.6	U	2	U	2.4	U	2	U	2	U	2.4	U	<u>1.3</u>	U	1.6	U				
Radium-226	1.51		0.931		0.348	J	2.092	<u>11.6</u>	J	1.35	J	1.31		<u>15.1</u>	J	<u>2.66</u>	J	2.09	J	1.95	J	<u>3.11</u>	J	<u>3.07</u>	J	<u>4.2</u>		1.94		0.954	J				
Radium-228	0.575		0.331		0.191	J	0.754	<u>2.75</u>	J	0.29	J	0.506		0.348	J	0.467	J	0.448	J	0.488	J	0.675	J	0.635	J	0.336		0.399		0.435	J				
Uranium-235	0.0946		0.0584		0.0218	J	0.131	<u>0.574</u>	J	0.0846	J	0.0856		<u>0.904</u>	J	<u>0.167</u>	J	<u>0.131</u>	J	0.122	J	NA		<u>0.186</u>	J	<u>0.251</u>		NA		0.0599	J				
Uranium and Thorium by Extraction Chromatography/Alpha Spectrometry																																			
Uranium-234	0.775		0.523		0.396		0.950	<u>10.4</u>		0.795		0.57		<u>3.18</u>		<u>1.16</u>		0.858		<u>2.77</u>		<u>2.02</u>		<u>1.48</u>		<u>1.66</u>		<u>0.994</u>		0.479					
Uranium-238	0.027	U	0.072	U	0.052	U	MDC	<u>0.504</u>		0.058	U	0.05	U	<u>0.159</u>		<u>0.13</u>		0.046	U	<u>0.255</u>		<u>0.257</u>		0.056	U	<u>0.177</u>		<u>0.0823</u>		0.028	U				
Uranium-238	0.634		0.551		0.294		0.848	<u>8.77</u>		0.624		0.533		<u>3.46</u>		<u>1.21</u>		0.708		<u>2.11</u>		<u>2.01</u>		<u>1.44</u>		<u>1.4</u>		<u>0.967</u>		0.513					
Thorium-227	0.14	U	0.084	U	0.634	U	MDC	<u>0.584</u>		0.069	U	0.064	U	<u>0.188</u>		0.038	U	0.037	U	<u>0.214</u>		0.057	U	0.073	U	0.036	U	0.034	U	0.071	U				
Thorium-228	0.343		0.283		0.31		0.372	<u>2.6</u>		<u>0.406</u>		<u>0.484</u>		0.357		<u>0.448</u>		<u>0.461</u>		<u>0.439</u>		<u>0.755</u>		<u>0.71</u>		<u>0.396</u>		<u>0.48</u>		<u>0.504</u>					
Thorium-230	0.708		0.33		0.268		1.045	<u>12.7</u>		0.578		0.422		<u>4.25</u>		<u>1.11</u>		0.513		<u>12.1</u>		<u>1.35</u>		<u>1.3</u>		<u>2.19</u>		0.944		0.535					
Thorium-232	0.44		0.245		0.169		0.564	<u>2.35</u>		0.299		0.432		0.287		0.338		0.399		0.352		<u>0.585</u>		<u>0.588</u>		0.378		0.301		0.394					
<div>CRQL: Contract Required Quantitation Limit. Number in parentheses is CRQL.</div> <div>MDC: Minimum Detectable Concentration</div> <div>*: Value adjusted in accordance with EPA 540-F-94-028.</div> <div>** : Value is still stignificantly above background when adjusted in accordance with EPA 540-F-94-028.</div> <div>U: Analyte not detected.</div> <div>J: Data are estimated.</div> <div><b>Bold:</b> Bold and underlined data are significantly above background.</div>																																			

**Table 3-3: 2004 Draft SI Reassessment Surface Water Sampling**

	Background Samples			Release Samples							
Sample ID CLP ID Date	SW-1 MY1B56 4/30/2004		Significantly Above Background	SW-2 MY1B57 4/27/2004		SW-3 MY1B58 4/27/2004		SW-4 MY1B59 4/28/2004		SW-5 MY1B60 4/29/2004	
	Result	Val		Result	Val	Result	Val	Result	Val	Result	Val
Metals (ug/l)											
Aluminum	92.6	J	277.8	136	J	145	J	111	J	226	
Antimony	60	U	CRQL (60)	60	U	60	U	60	U	60	U
Arsenic	10	U	CRQL (10)	4.5	J	10	U	1.9	J	3.2	J
Barium	149	J	447	153	J	159	J	151	J	66.8	J
Beryllium	5	U	CRQL (5)	5	U	5	U	5	U	5	U
Cadmium	5	U	CRQL (5)	5	U	5	U	5	U	5	U
Calcium	82,400		247,200	67,900		69,800		102,000		101,000	
Chromium	10	U	CRQL (10)	10	U	10	U	10	U	10	U
Cobalt	50	U	CRQL (50)	50	U	50	U	50	U	50	U
Copper	25	U	CRQL (25)	4	J	25	U	25	U	25	U
Iron	24.6	J	73.8	63.2	J	59.7	J	28.6	J	<u>92.2</u>	J
Lead	10	U	CRQL (10)	10	U	10	U	10	U	10	U
Magnesium	17,500		52,500	24,600		25,300		41,400		43,200	
Manganese	15	U	CRQL (15)	<u>36.7</u>		14.4	J	8.5	J	<u>19.9</u>	
Mercury	0.2	U	CRQL (0.2)	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	40	U	CRQL (40)	40	U	40	U	40	U	40	U
Potassium	5,000	U	CRQL (5,000)	1,610	J	1,680	J	7,570		2,400	J
Selenium	35	U	CRQL (35)	35	U	35	U	35	U	35	U
Silver	10	U	CRQL (40)	40	U	10	U	10	U	10	U
Sodium	21,200		63,600	28,800		29,900		<u>318,000</u>		<u>166,000</u>	
Thallium	6.3	J	18.9	25	U	25	U	25	U	25	U
Vanadium	5.7	J	17.1	6.4	J	6.5	J	<u>19.4</u>	J	10.3	J
Zinc	33.9	J	101.7	2.9	J	60	U	60	U	9.9	J
Radionuclides (pCi/l)											
Radium-226 by Radon Emanation											
Radium-226	0.0884	U	MDC	0.263	U	0.239	U	<u>0.959</u>		0.131	U
Radium-228 by Gas Proportional Counting											
Radium-228	1	U	MDC	1.1	U	1.1	U	1.1	U	1	U
Uranium and Thorium by Extraction Chromatography/Alpha Spectrometry											
Uranium-234	1.69		3.380	2.85		2.73		<u>26.6</u>		<u>6.52</u>	
Uranium-235	0.0943		0.189	0.101		0.0804	U	<u>1.96</u>	J	<u>0.231</u>	
Uranium-238	0.906		1.812	1.61		1.66		22.5		3.81	

CRQL: Contract Required Quantitation Limit. Number in parentheses is CRQL.

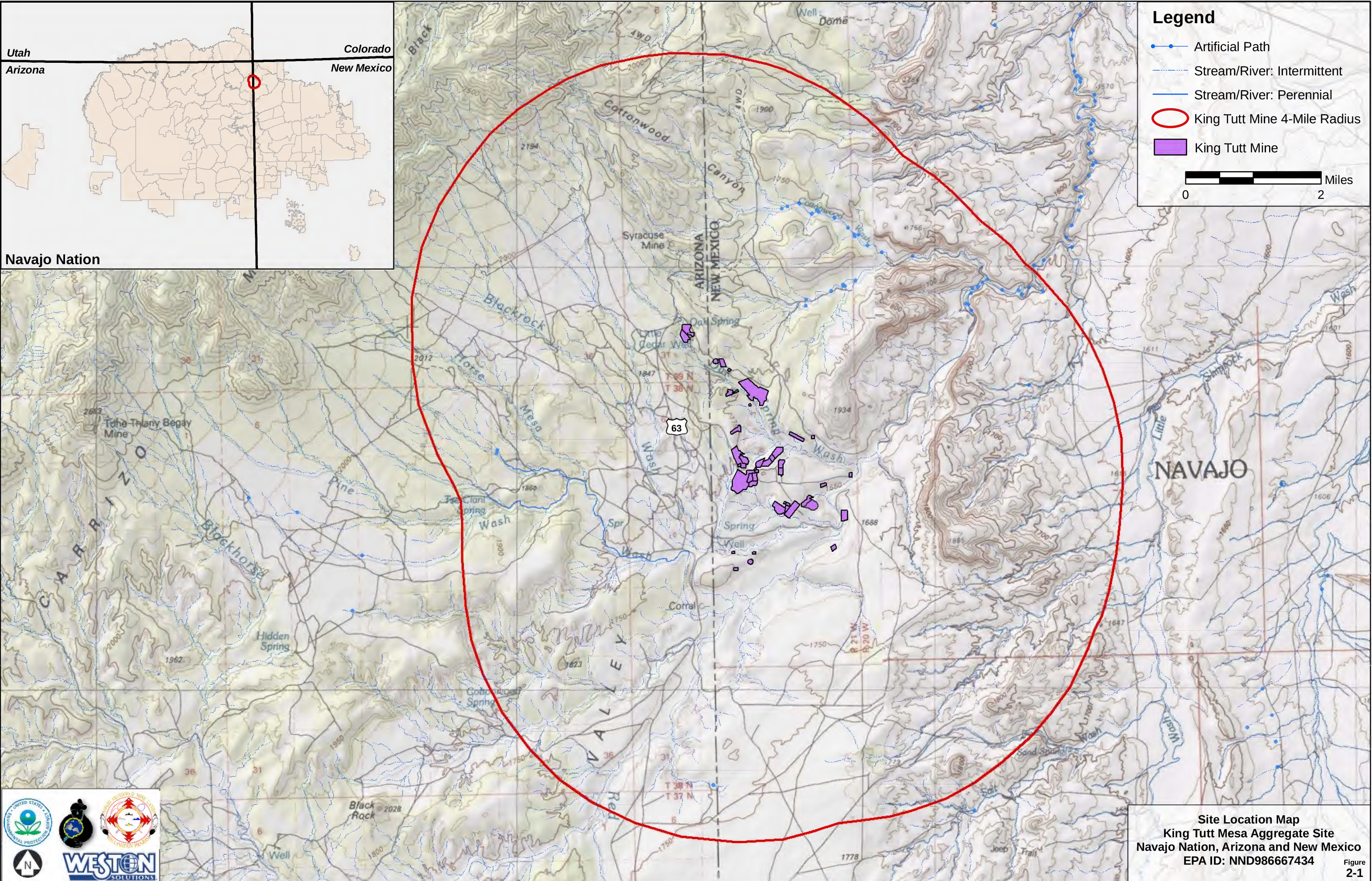
MDC: Minimum Detectable Concentration

U: Analyte not detected.

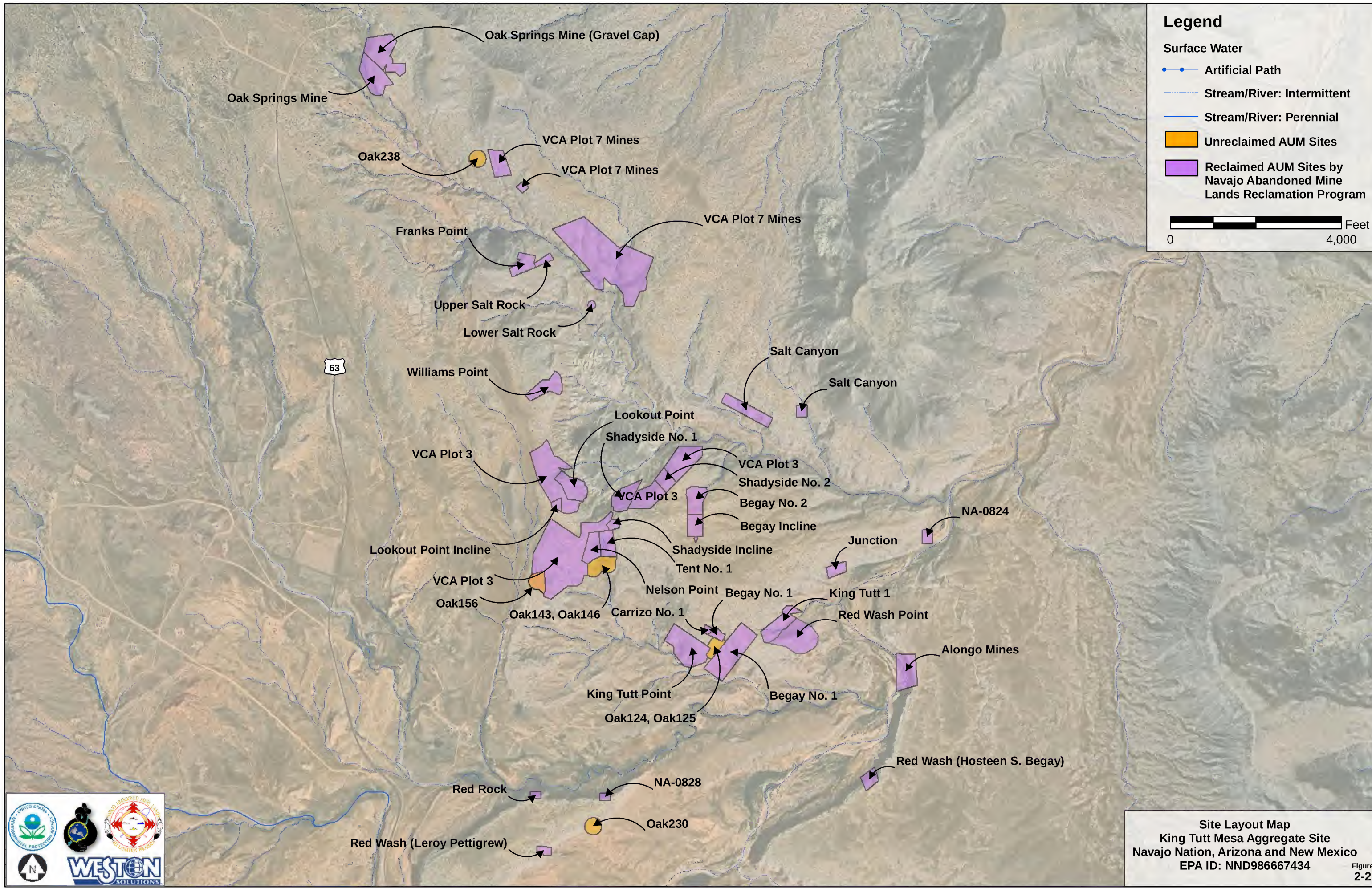
J: Data are estimated.

**Bold:** Bold and underlined data are significantly above background.





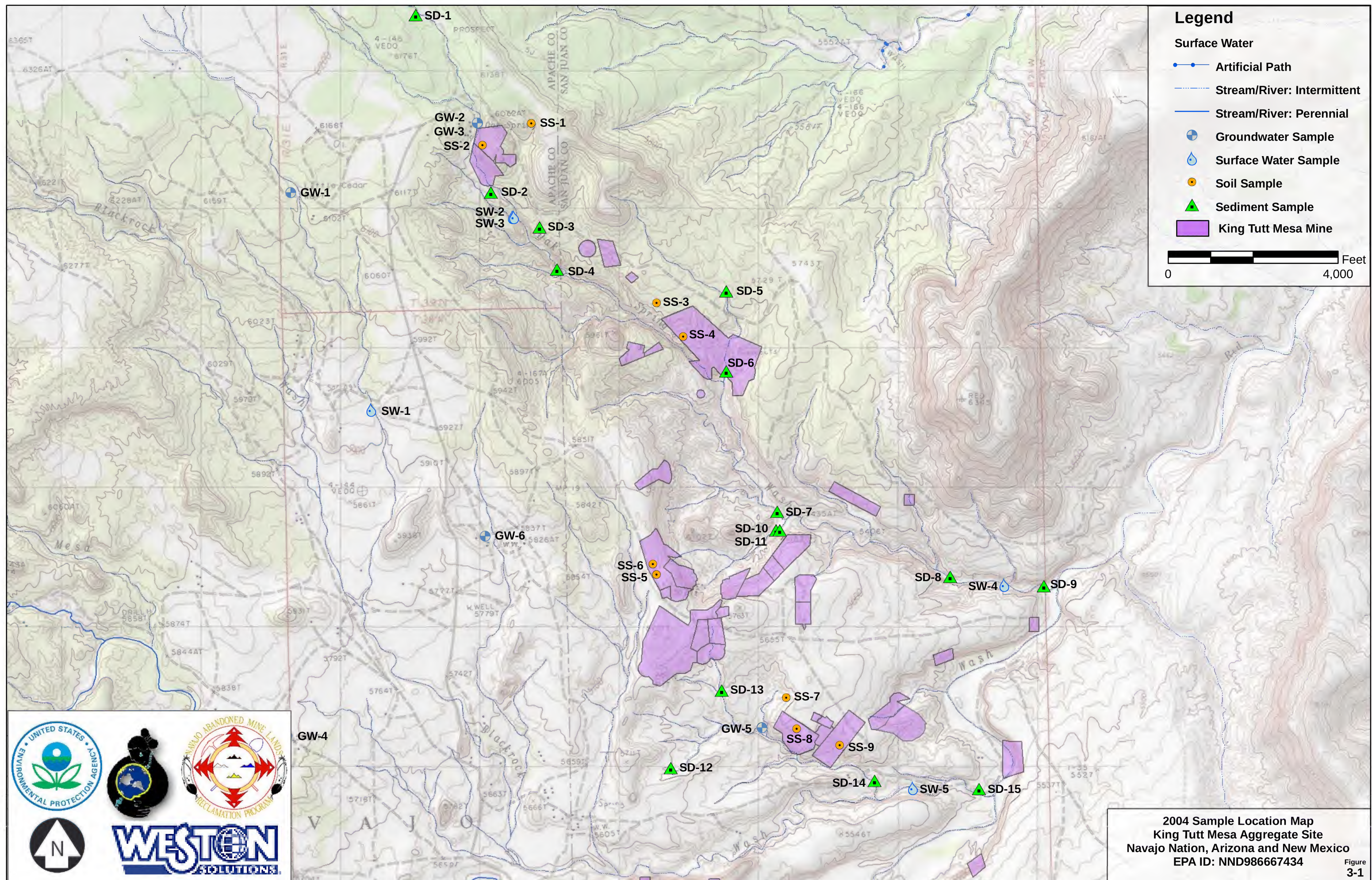
Site Location Map  
King Tutt Mesa Aggregate Site  
Navajo Nation, Arizona and New Mexico  
EPA ID: NND986667434

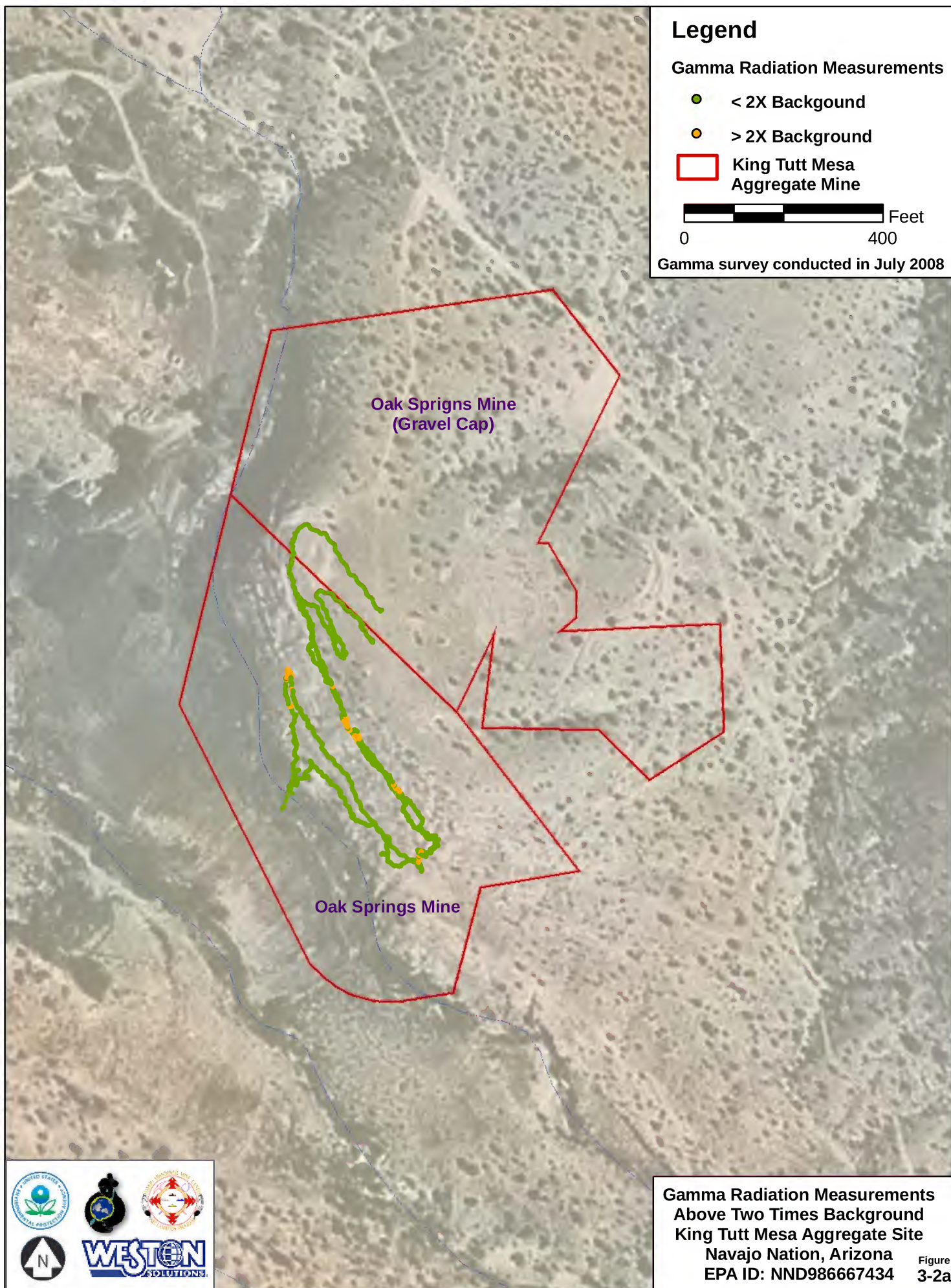


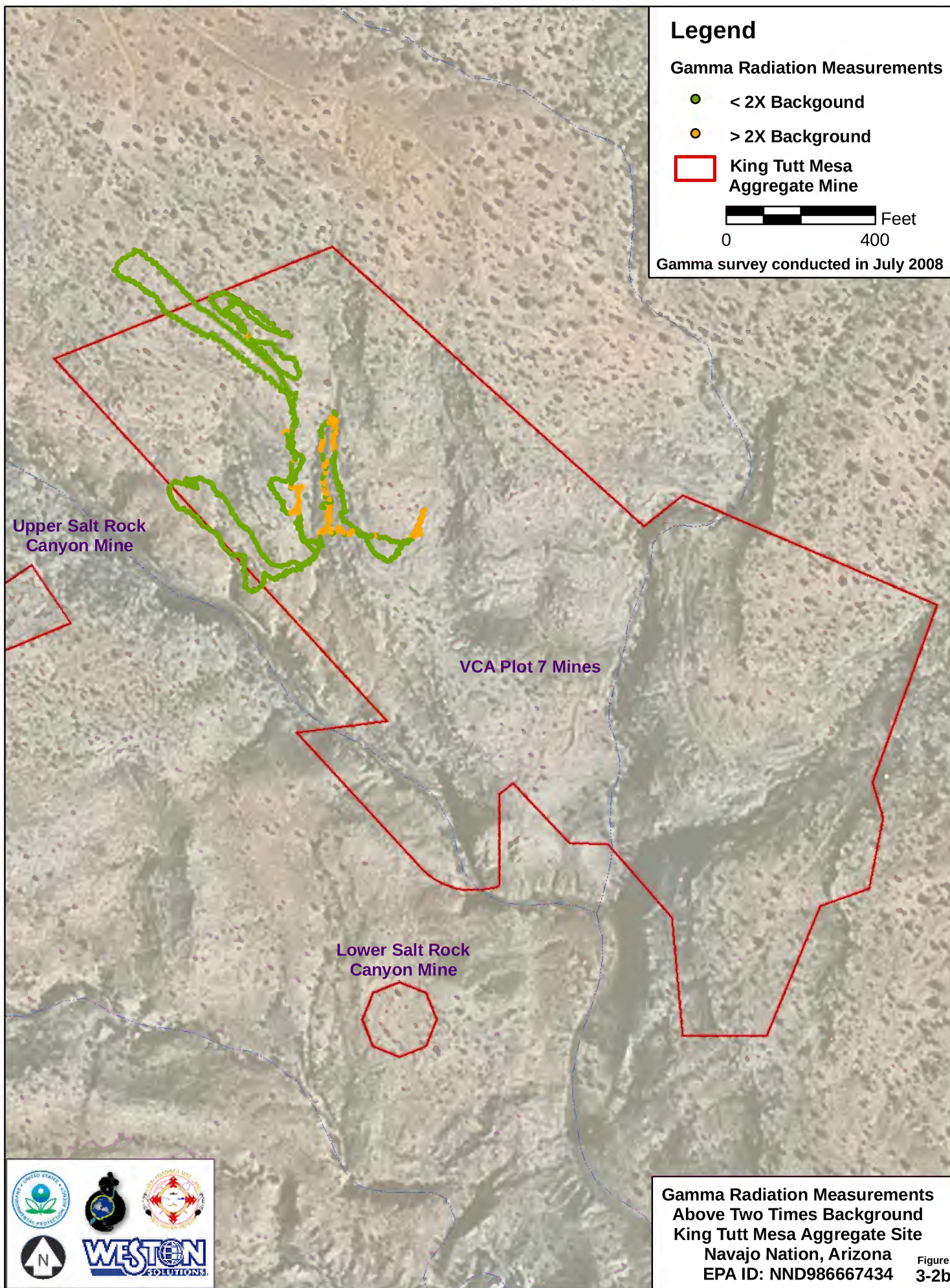
**Site Layout Map**  
King Tutt Mesa Aggregate Site  
Navajo Nation, Arizona and New Mexico  
EPA ID: NND986667434  
Figure 2-2

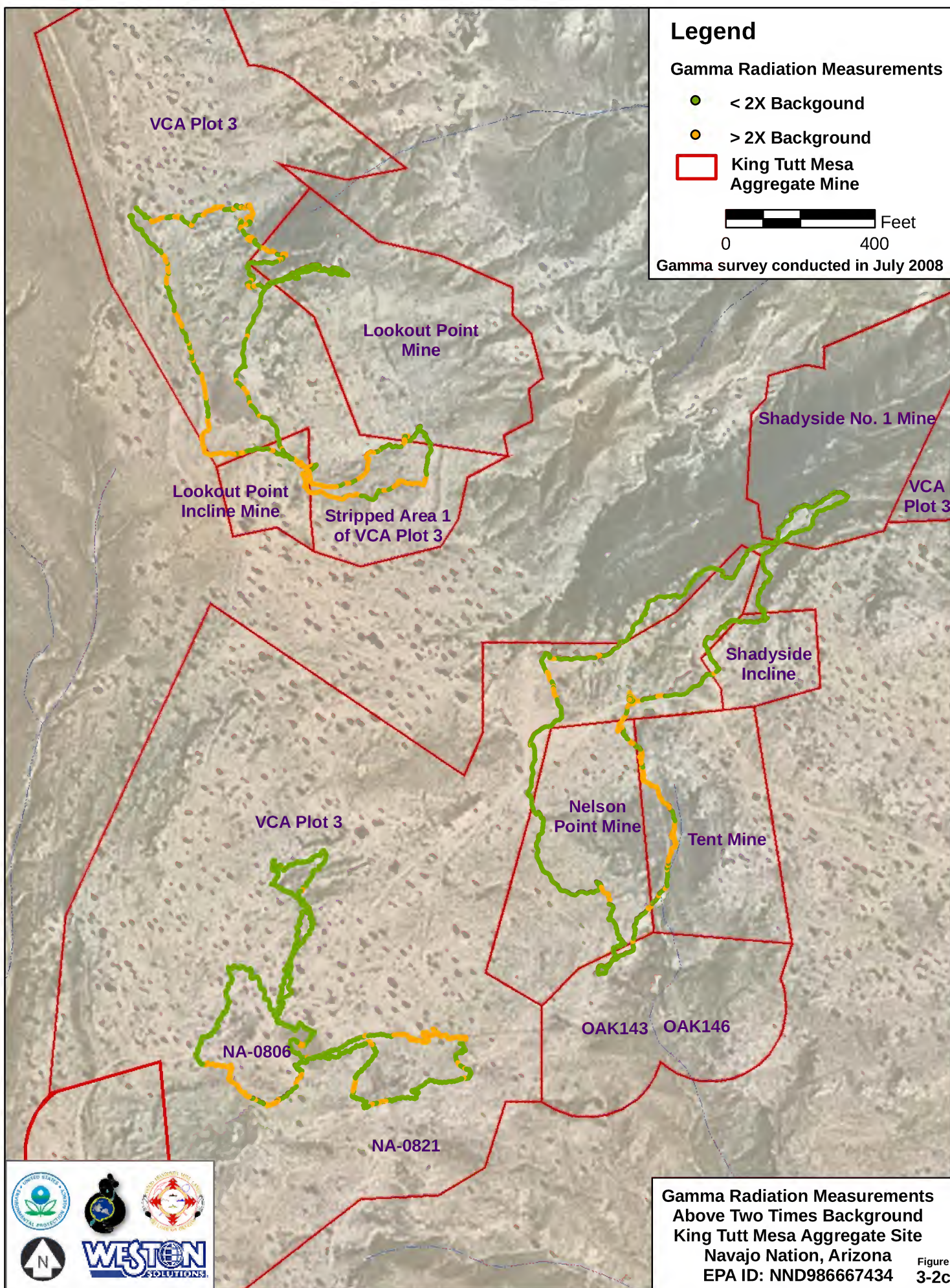


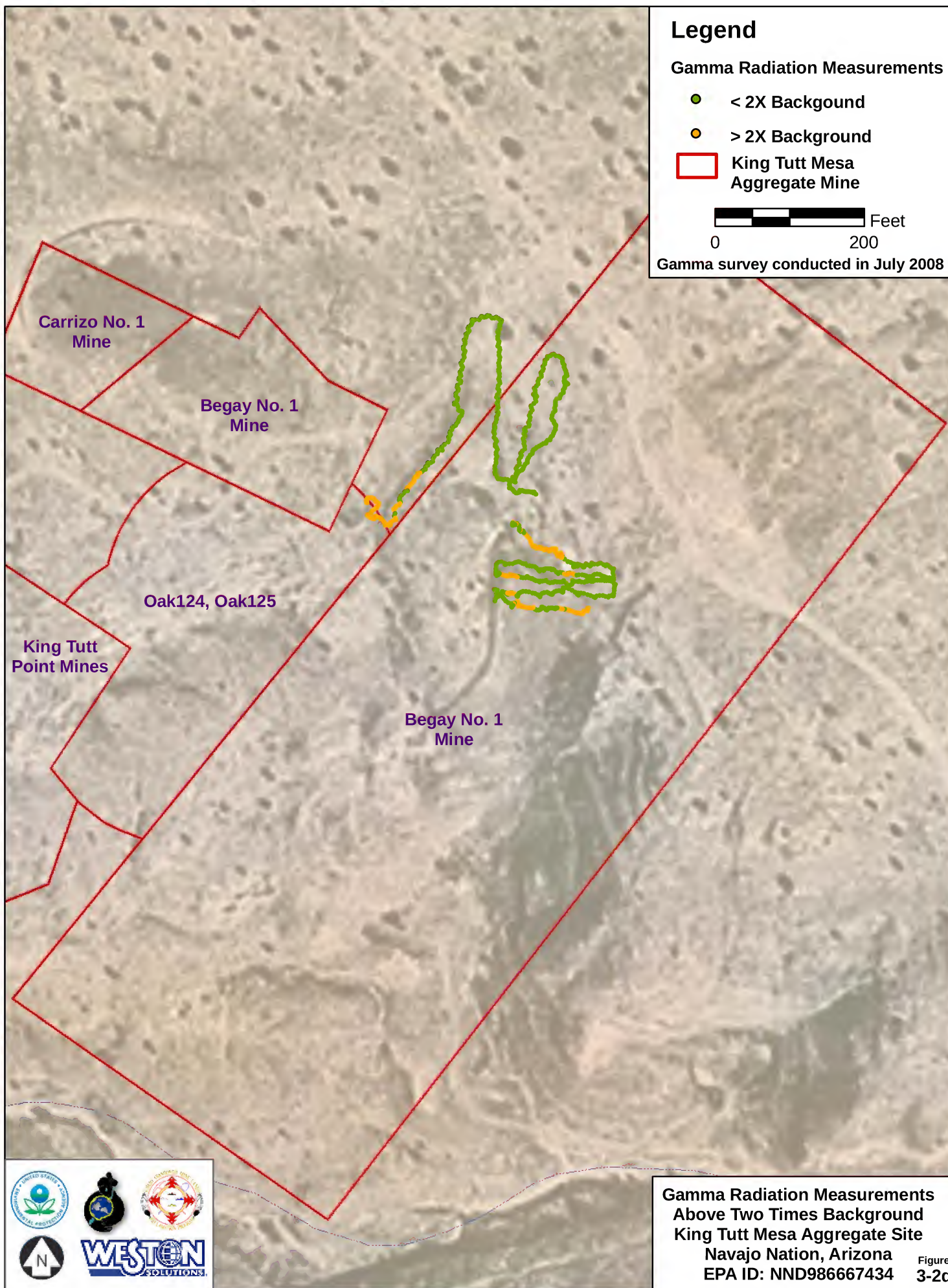
**2004 Sample Location Map  
King Tutt Mesa Aggregate Site  
Navajo Nation, Arizona and New Mexico  
EPA ID: NND986667434**

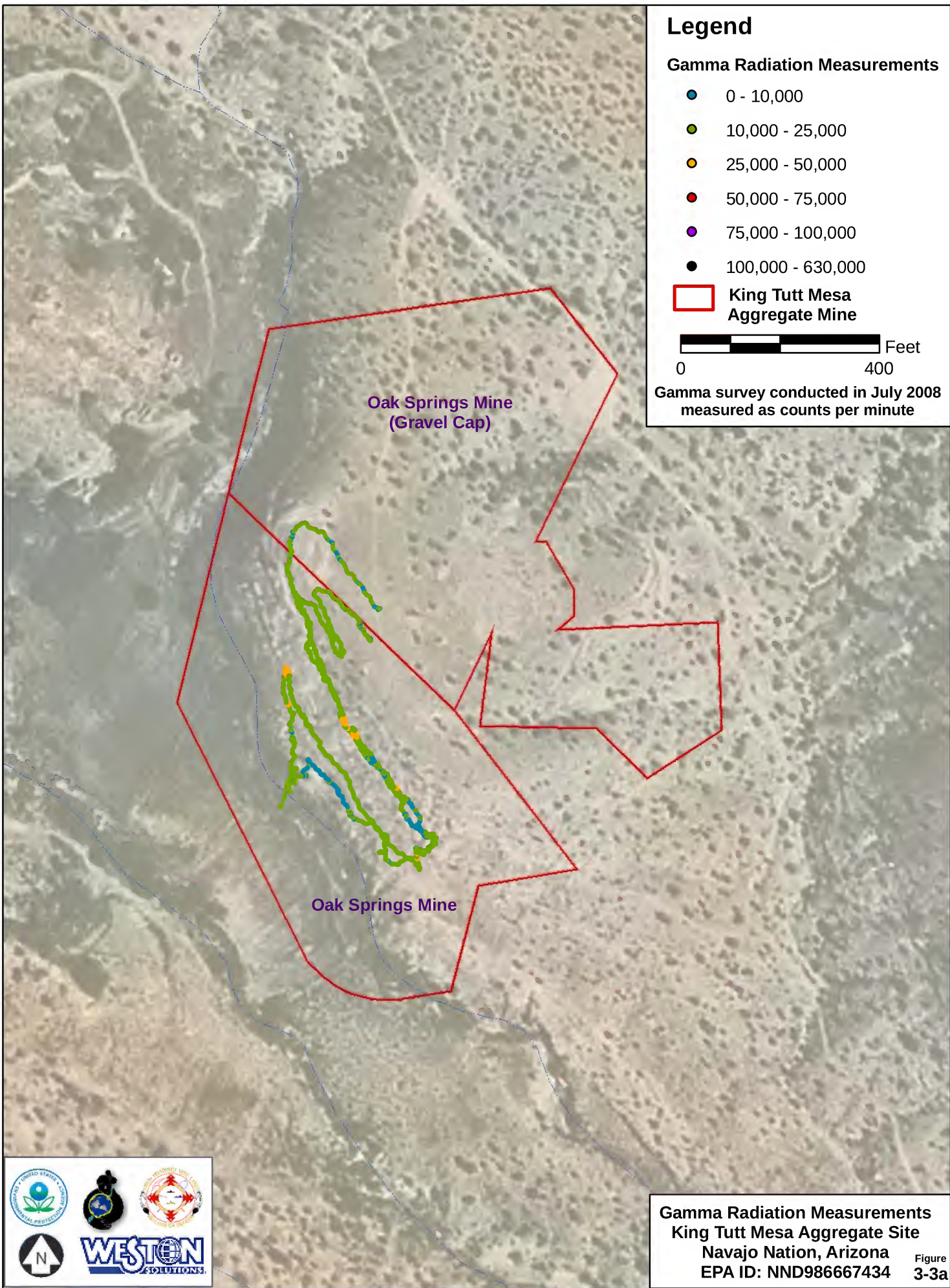












# Legend

## Gamma Radiation Measurements

- 0 - 10,000
- 10,000 - 25,000
- 25,000 - 50,000
- 50,000 - 75,000
- 75,000 - 100,000
- 100,000 - 630,000

King Tutt Mesa Aggregate Mine

0 400 Feet

Gamma survey conducted in July 2008  
measured as counts per minute

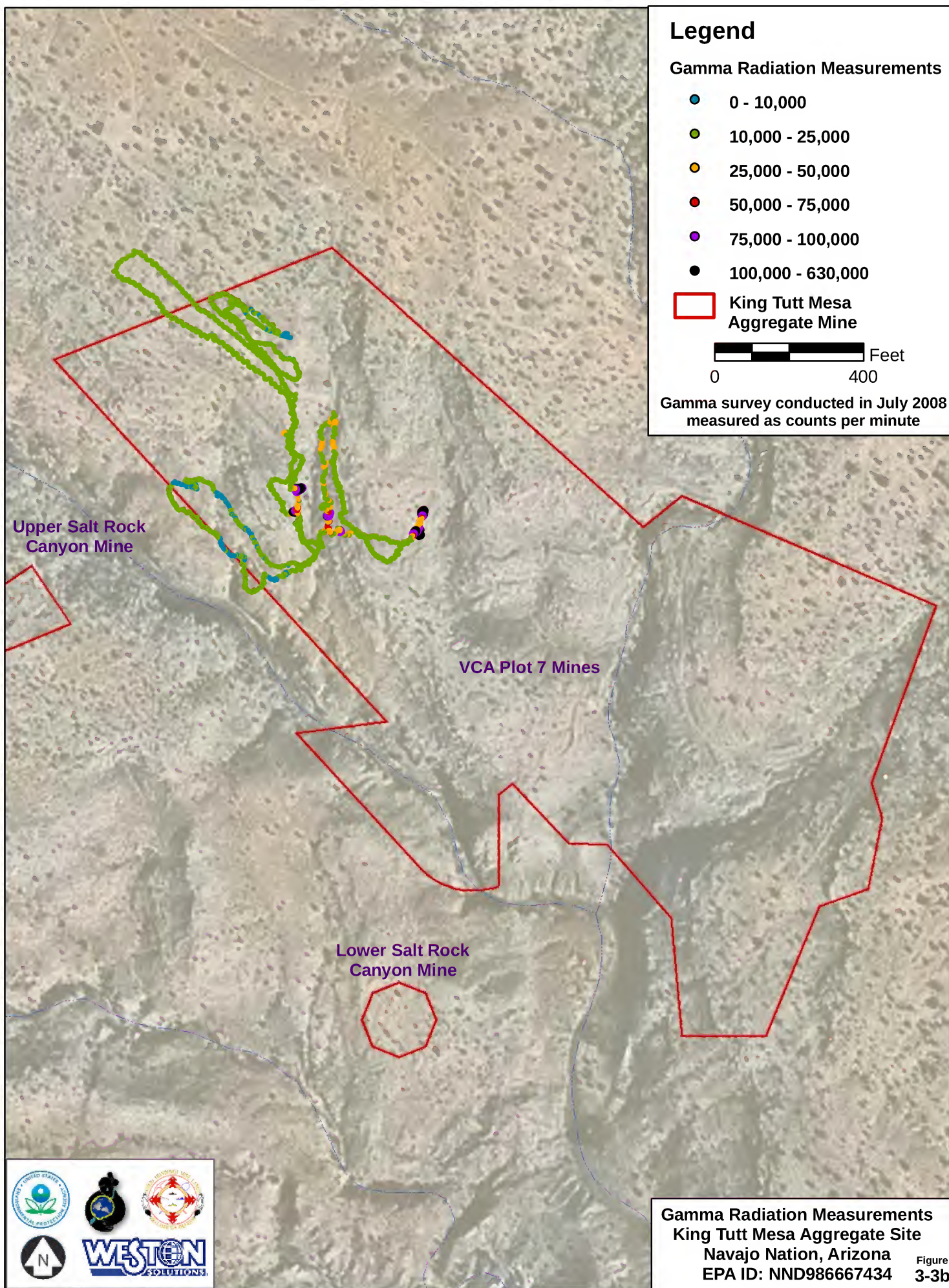
Oak Springs Mine  
(Gravel Cap)

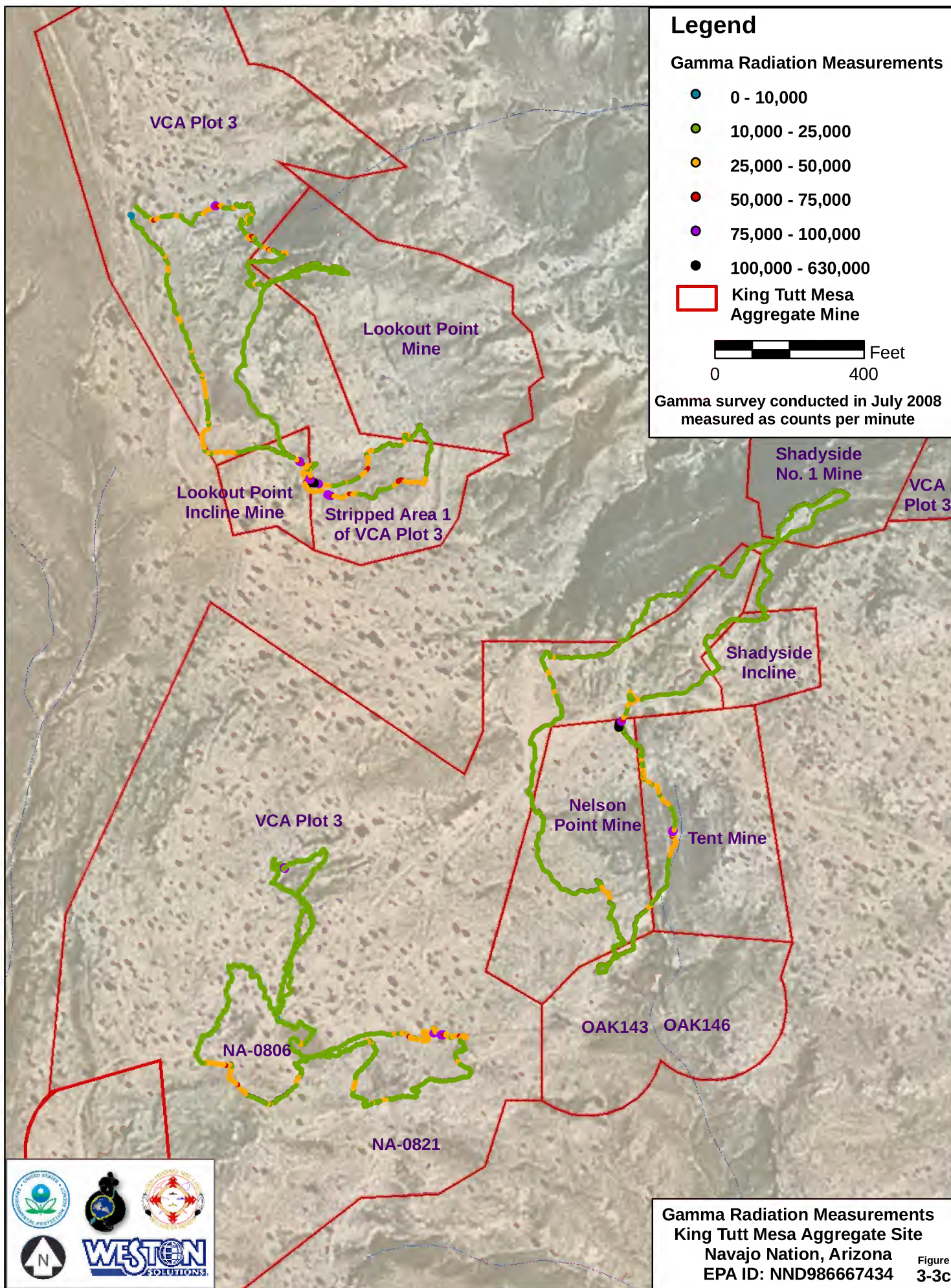
Oak Springs Mine

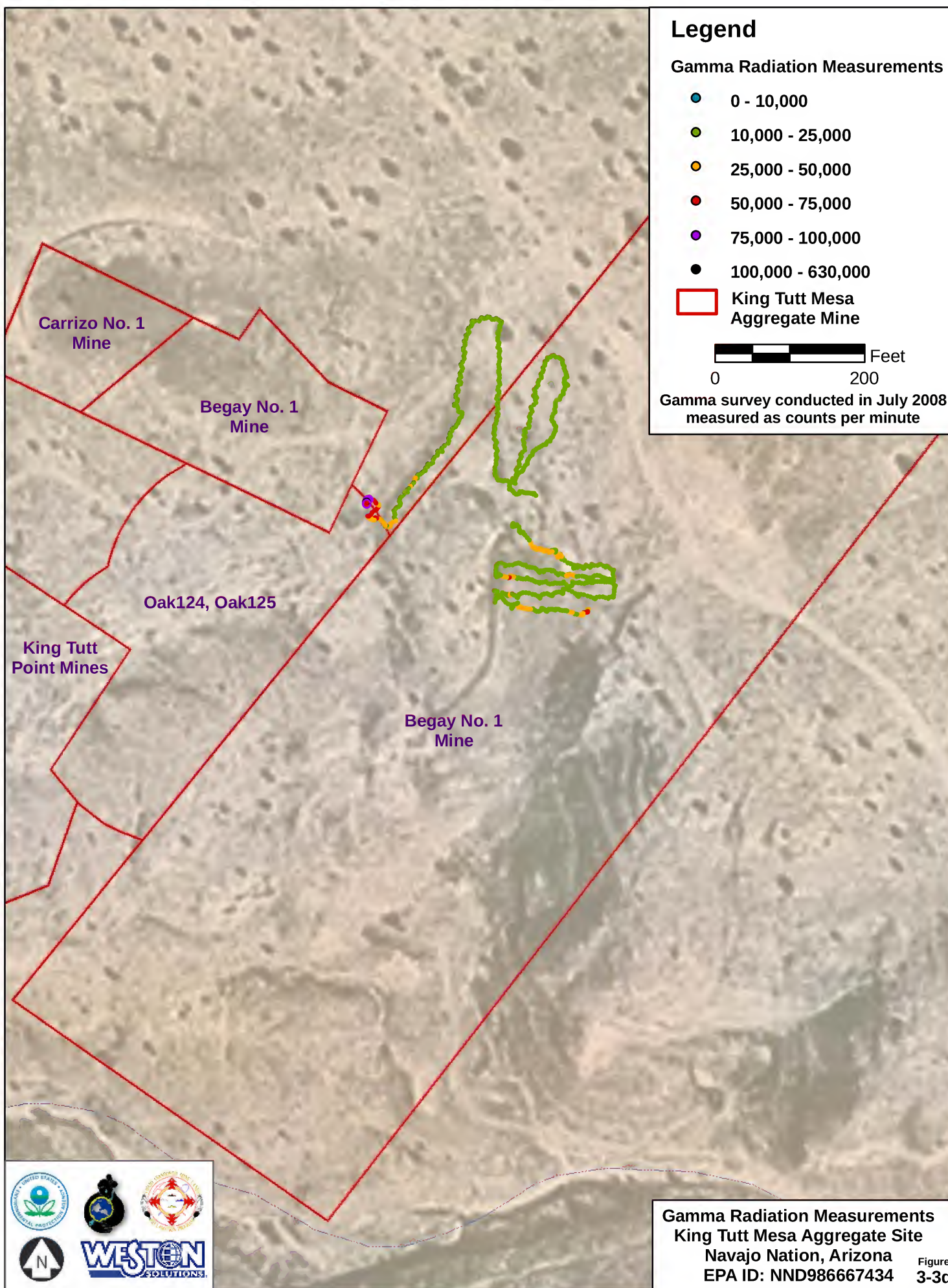
Gamma Radiation Measurements  
King Tutt Mesa Aggregate Site  
Navajo Nation, Arizona  
EPA ID: NND986667434

Figure  
3-3a









**ATTACHMENT A:  
2010 Gamma Radiation Survey**

## **2010 Gamma Radiation Survey**

### **King Tutt Mesa Site**

**EPA ID No. NND986667434**

A Reassessment report was completed for the King Tutt Mesa (KTM) site (EPA ID No. NND986667434), submitted to the United States Environmental Protection Agency (EPA) Region 9, by Weston Solutions, Inc (Weston) in September, 2008. Following the completion of the 2008 report, the EPA and Weston acquired additional information pertaining to the 41 mines sites which constitute the King Tutt Mesa site.

In June, 2010, EPA tasked Weston with revisiting 32 of the 41 mine sites, as part of the continuing Navajo Abandoned Uranium Mines (AUM) radiological screening project. As part of a limited site screen, new gamma radiation measurements, additional site reconnaissance and further documentation took place at each site. The gamma radiation measurement results, site photographs, and gamma radiation maps from the 2010 limited site screens are presented in the following pages.

**Site:** Red Wash (Leroy Pettigrew)

**Mine ID:** 1

**Highest gamma radiation measurement:**

28,867 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 1,094 gamma radiation measurements were collected from the mine site, ranging from 6,537 cpm to 28,867 cpm. The measurements are represented in Figures A-1 and A-2.

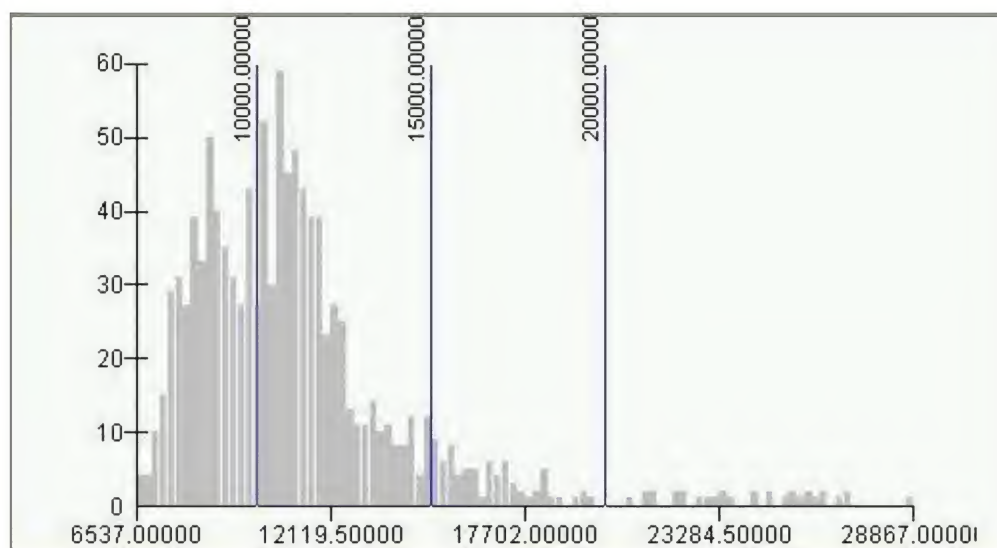
**Background Locations**

#1 8,386 cpm

**Average background = 8,386 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1094
Minimum:	6537.00000
Maximum:	28867.00000
Sum:	12219421.00000
Mean:	11169.48903
Median:	10639.50000
Standard Deviation:	3296.27093



Photo 1. Red Wash (Leroy Pettigrew) (1) site



Photo 2. Red Wash (Leroy Pettigrew) (1) site

**Site:** Alongo Mines

**Mine ID:** 2

**Highest gamma radiation measurement:**

202,577 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 4,656 gamma radiation measurements were collected from the mine site, ranging from 7,380 cpm to 202,577 cpm. The measurements are represented in Figures A-3 and A-4.

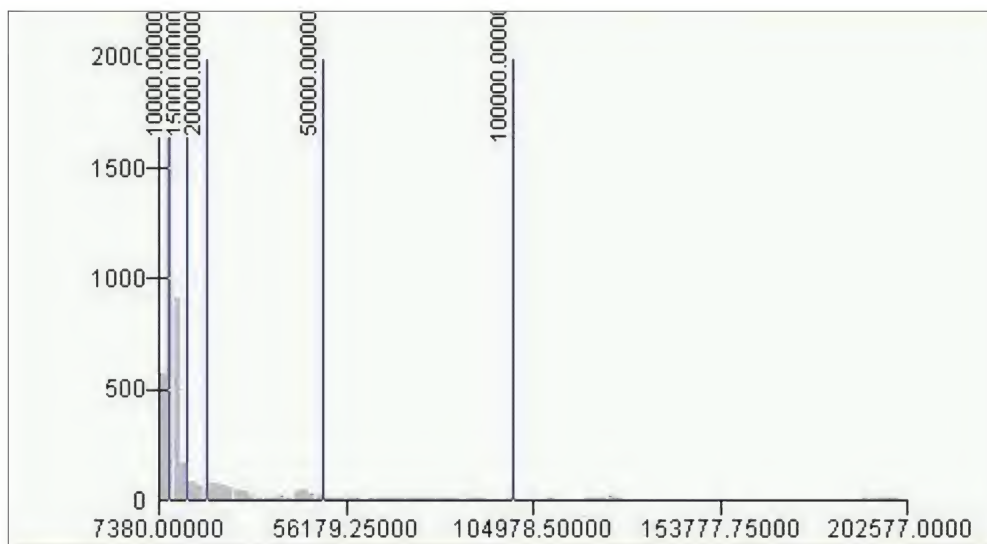
**Background Locations**

#1 10,310 cpm

**Average background = 10,310 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	4656
Minimum:	7380.00000
Maximum:	202577.00000
Sum:	94894075.00000
Mean:	20381.02985
Median:	11041.50000
Standard Deviation:	28014.66724



Photo 1. Alongo Mines (2) site



Photo 2. Alongo Mines (2) site



Photo 3. Alongo Mines (2) site



Photo 4. Alongo Mines (2) site



Photo 5. Alongo Mines (2) site



Photo 6. Alongo Mines (2) site

**Site:** Red Wash Point

**Mine ID:** 3

**Highest gamma radiation measurement:**

377,016 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 2,718 gamma radiation measurements were collected from the mine site, ranging from 8,316 cpm to 377,016 cpm. The measurements are represented in Figures A-5 and A-6.

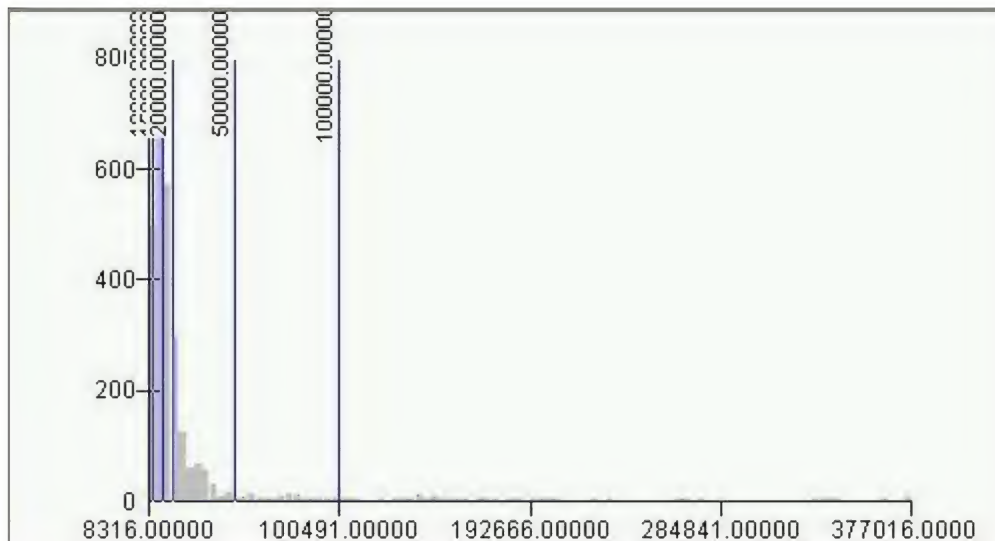
**Background Locations**

#1 10,567 cpm

**Average background = 10,567 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	2718
Minimum:	8316.00000
Maximum:	377016.00000
Sum:	76613022.00000
Mean:	28187.27815
Median:	16070.50000
Standard Deviation:	46062.60290



Photo 1. Red Wash Point (3) site



Photo 2. Red Wash Point (3) site



Photo 3. Red Wash Point (3) site



Photo 4. Red Wash Point (3) site

**Site:** Junction

**Mine ID:** 4

**Highest gamma radiation measurement:**

25,302 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 1,040 gamma radiation measurements were collected from the mine site, ranging from 6,974 cpm to 25,302 cpm. The measurements are represented in Figures A-7 and A-8.

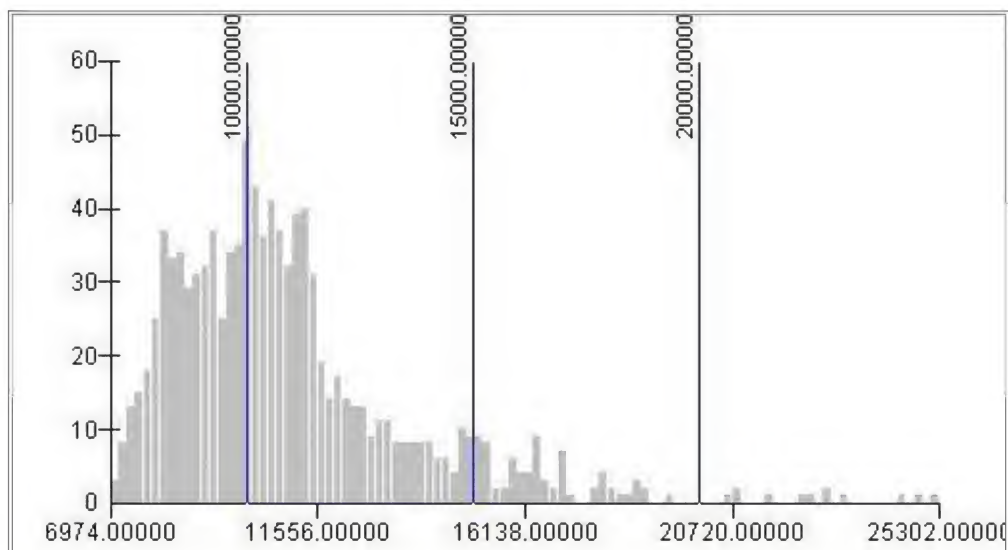
**Background Locations**

#1 8,229 cpm

**Average background = 8,229 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1040
Minimum:	6974.00000
Maximum:	25302.00000
Sum:	11332735.00000
Mean:	10896.86058
Median:	10361.00000
Standard Deviation:	2665.24576



Photo 1. Junction (4) site



Photo 2. Junction (4) site

**Site:** NA-0824

**Mine ID:** 5

**Highest gamma radiation measurement:**

54,893 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 983 gamma radiation measurements were collected from the mine site, ranging from 8,688 cpm to 54,893 cpm. The measurements are represented in Figures A-9 and A-10.

**Background Locations**

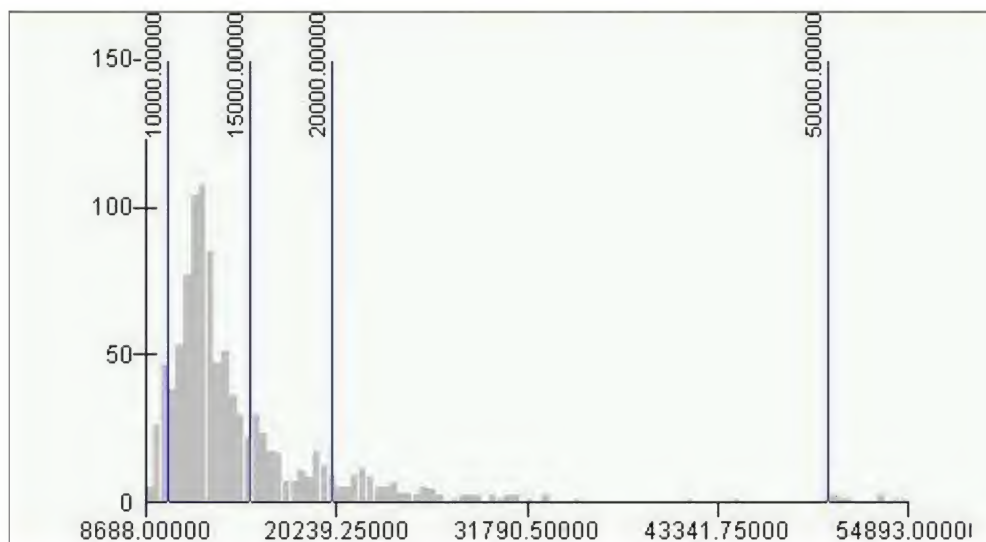
#1 8,925 cpm

#2 8,406 cpm

**Average background = 8,666 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	983
Minimum:	8688.00000
Maximum:	54893.00000
Sum:	14164818.00000
Mean:	14409.78433
Median:	12538.00000
Standard Deviation:	5677.56373



Photo 1. NA-0824 (5) site



Photo 2. NA-0824 (5) site

**Site:** Lookout Point Incline

**Mine ID:** 6

**Highest gamma radiation measurement:**

44,907 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 839 gamma radiation measurements were collected from the mine site, ranging from 9,690 cpm to 44,907 cpm. The measurements are represented in Figures A-11 and A-12.

**Background Locations**

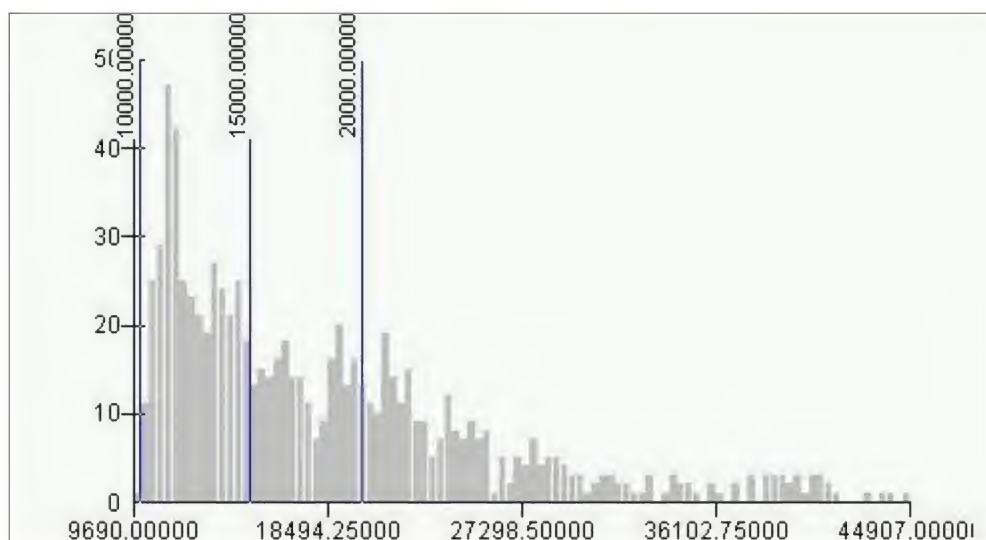
#1 10,888 cpm

#2 10,576 cpm

**Average background = 10,732 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	839
Minimum:	9690.00000
Maximum:	44907.00000
Sum:	15431671.00000
Mean:	18392.93325
Median:	16493.00000
Standard Deviation:	7250.30980



Photo 1. Lookout Point Incline (6) site



Photo 2. Lookout Point Incline (6) site

**Site:** Lookout Point

**Mine ID:** 9

**Highest gamma radiation measurement:**

155,642 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 1,111 gamma radiation measurements were collected from the mine site, ranging from 9,972 cpm to 155,642 cpm. The measurements are represented in Figures A-11 and A-12.

**Background Locations**

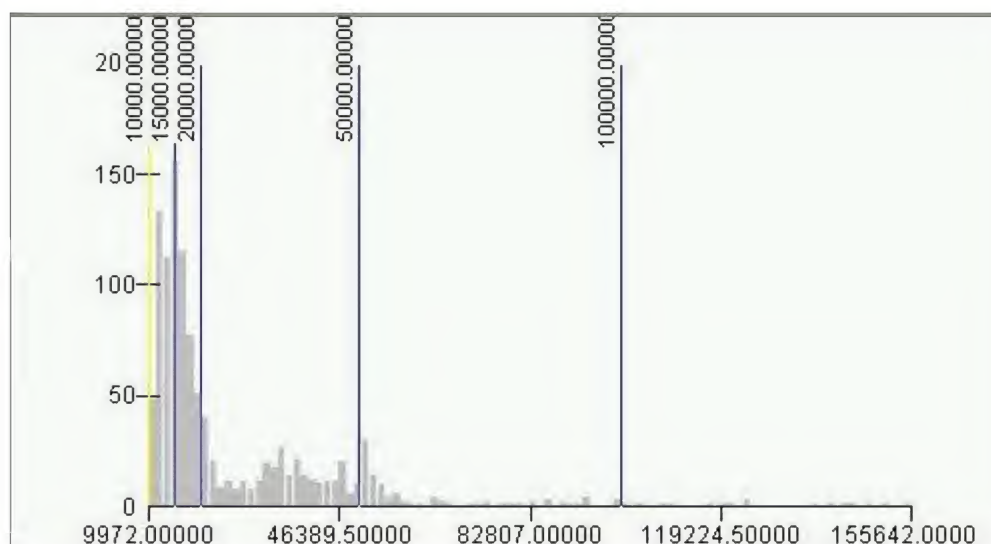
**Average background = 10,732 cpm**

#1 10,888 cpm

#2 10,576 cpm

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1111
Minimum:	9972.00000
Maximum:	155642.00000
Sum:	28901768.00000
Mean:	26014.19262
Median:	17140.00000
Standard Deviation:	20438.64898



Photo 1. Lookout Point (9) site



Photo 2. Lookout Point (9) site



Photo 3. Lookout Point (9) site



Photo 4. Lookout Point (9) site



Photo 1. Lookout Point (9) site, buried adit

**Site:** Begay No. 2

**Mine ID:** 10

**Highest gamma radiation measurement:**

207,381 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 2,261 gamma radiation measurements were collected from the mine site, ranging from 7,031 cpm to 207,381 cpm. The measurements are represented in Figures A-13 and A-14.

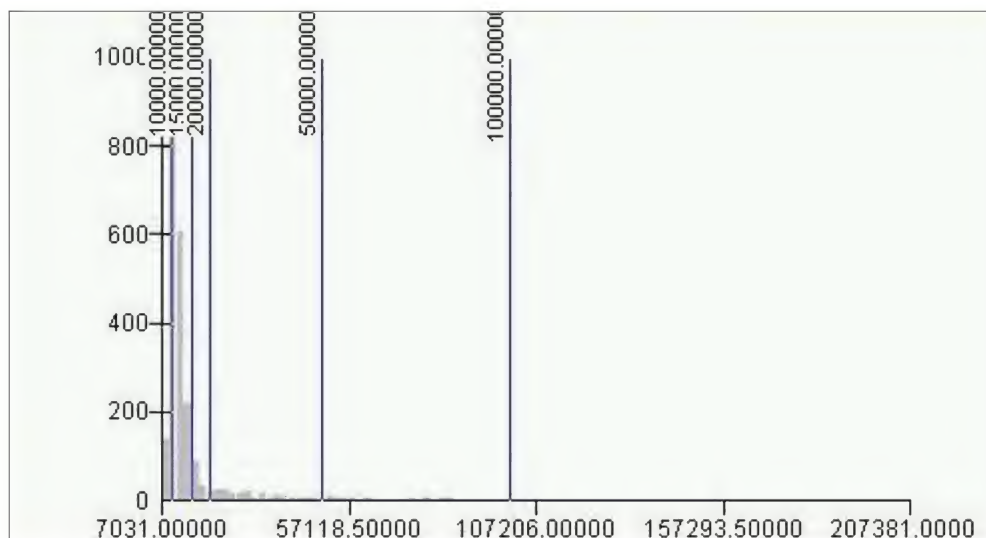
**Background Locations**

#1 10,559 cpm

**Average background = 10,559 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	2261
Minimum:	7031.00000
Maximum:	207381.00000
Sum:	38251009.00000
Mean:	16917.73950
Median:	11247.00000
Standard Deviation:	22576.08006



Photo 1. Begay No. 2 (10) site



Photo 2. Begay No. 2 (10) site



Photo 3. Begay No. 2 (10) site



Photo 4. Begay No. 2 (10) site



Photo 5. Begay No. 2 (10) site



Photo 6. Begay No. 2 (10) site



Photo 7. Begay No. 2 (10) site



Photo 8. Begay No. 2 (10) site



Photo 9. Begay No. 2 (10) site

**Site:** Williams Point

**Mine ID:** 12

**Highest gamma radiation measurement:**

210,262 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 4,742 gamma radiation measurements were collected from the mine site, ranging from 4,738 cpm to 210,262 cpm. The measurements are represented in Figures A-15 and A-16.

**Background Locations**

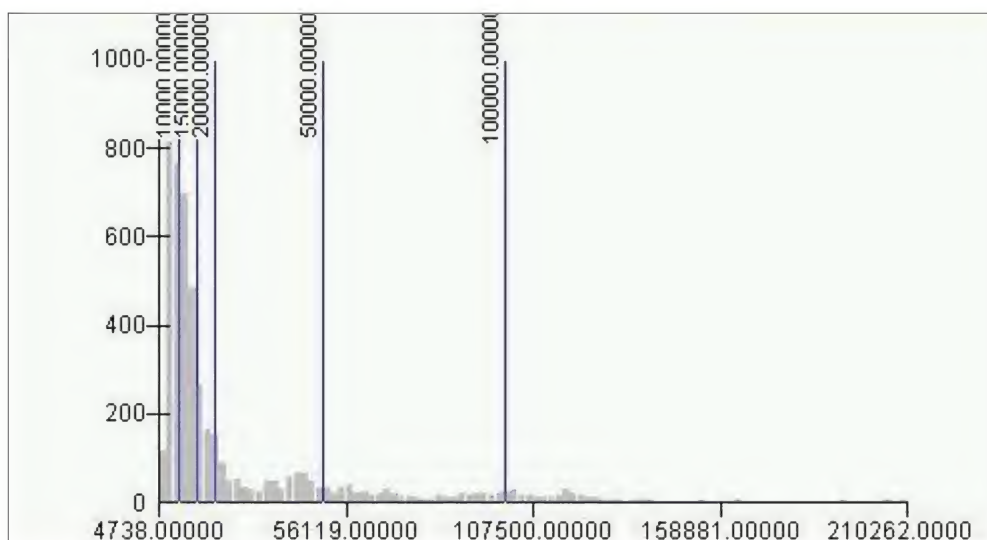
**Average background = 9,257 cpm**

#1 8,854 cpm

#2 9,658 cpm

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	4742
Minimum:	4738.00000
Maximum:	210262.00000
Sum:	123153379.00000
Mean:	25970.76740
Median:	12928.50000
Standard Deviation:	30496.43169



Photo 1. Williams Point (12) site



Photo 2. Williams Point (12) site



Photo 3. Williams Point (12) site



Photo 4. Williams Point (12) site



Photo 5. Williams Point (12) site

**Site:** Salt Canyon

**Mine ID:** 13

**Highest gamma radiation measurement:**

31,184 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 1,687 gamma radiation measurements were collected from the mine site, ranging from 6,147 cpm to 31,184 cpm. The measurements are represented in Figures A-17 and A-18.

**Background Locations**

**Average background = 8,200 cpm**

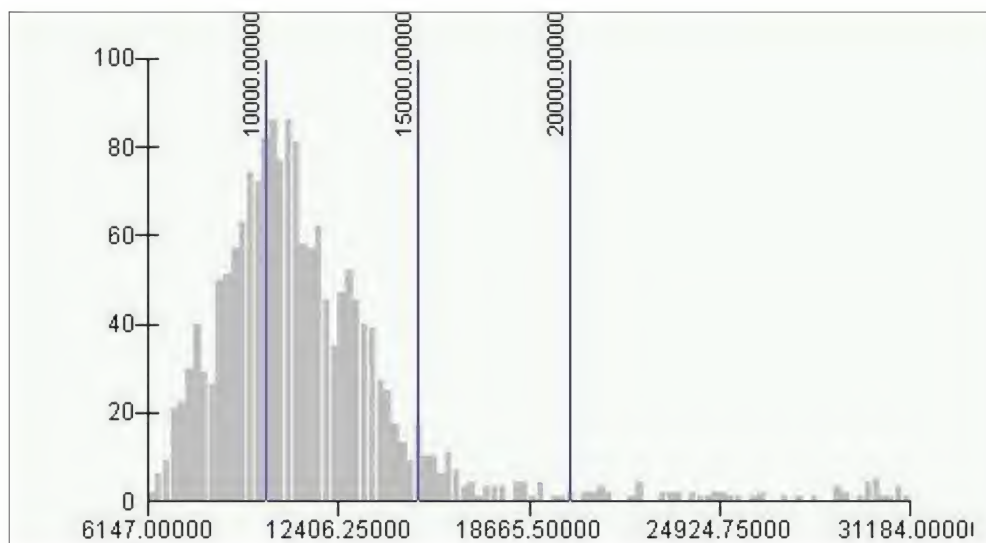
#1 8,593 cpm

#2 8,206 cpm

#3 7,802 cpm

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1687
Minimum:	6147.00000
Maximum:	31184.00000
Sum:	19365927.00000
Mean:	11479.50622
Median:	10791.00000
Standard Deviation:	3570.74230



Photo 1. Salt Canyon (13) site



Photo 2. Salt Canyon (13) site



Photo 3. Salt Canyon (13) site



Photo 4. Salt Canyon (13) site



Photo 5. Salt Canyon (13) site

**Site:** Salt Canyon

**Mine ID:** 14

**Highest gamma radiation measurement:**

11,988 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 618 gamma radiation measurements were collected from the mine site, ranging from 6,740 cpm to 11,988 cpm. The measurements are represented in Figures A-19 and A-20.

**Background Locations**

**Average background = 8,200 cpm**

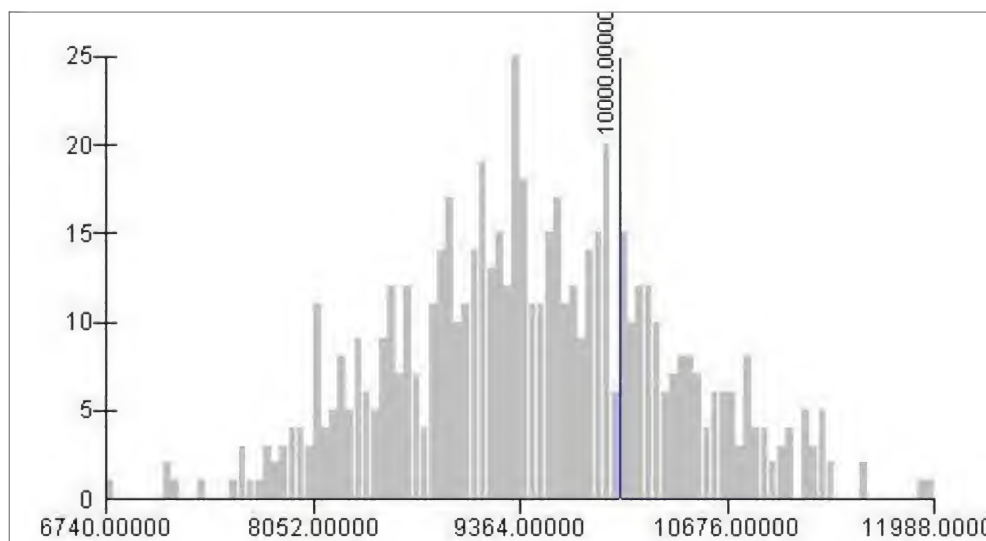
#1 8,593 cpm

#2 8,206 cpm

#3 7,802 cpm

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	618
Minimum:	6740.00000
Maximum:	11988.00000
Sum:	5835943.00000
Mean:	9443.27346
Median:	9403.00000
Standard Deviation:	864.87784



Photo 1. Salt Canyon (14) site



Photo 2. Salt Canyon (14) site



Photo 3. Salt Canyon (14) site

**Site:** Franks Point

**Mine ID:** 15

**Highest gamma radiation measurement:**

122,025 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 3,371 gamma radiation measurements were collected from the mine site, ranging from 5,878 cpm to 122,025 cpm. The measurements are represented in Figures A-21 and A-22.

**Background Locations**

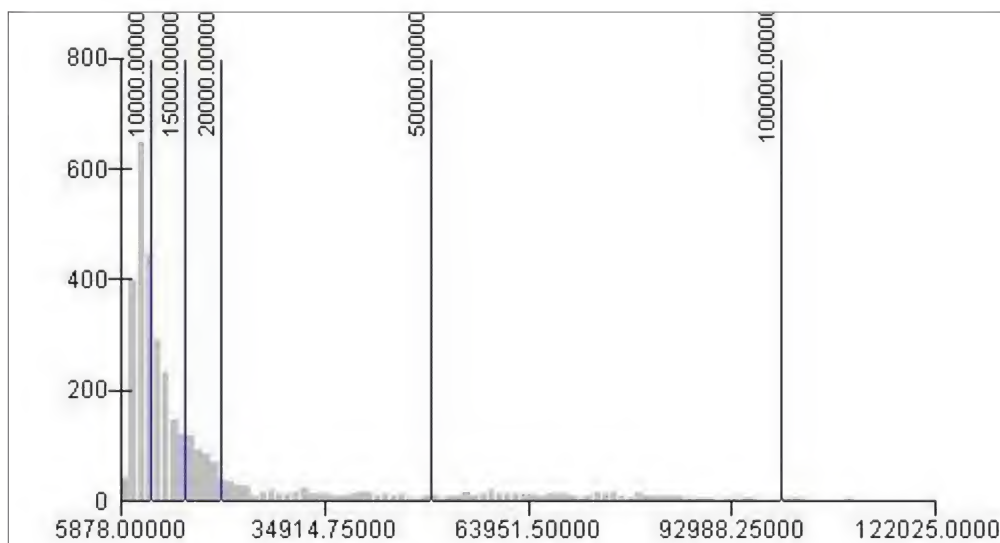
**Average background = 7,855 cpm**

#1 8,497 cpm

#2 7,213 cpm

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	3371
Minimum:	5878.00000
Maximum:	122025.00000
Sum:	64654889.00000
Mean:	19179.73569
Median:	11049.00000
Standard Deviation:	19483.32168



Photo 1. Franks Point (15) site



Photo 2. Franks Point (15) site



Photo 3. Franks Point (15) site



Photo 4. Franks Point (15) site



Photo 5. Franks Point (15) site



Photo 6. Franks Point (15) site



Photo 7. Franks Point (15) site



Photo 8. Franks Point (15) site

**Site:** Upper Salt Rock

**Mine ID:** 16

**Highest gamma radiation measurement:**

186,692 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 577 gamma radiation measurements were collected from the mine site, ranging from 7,142 cpm to 186,692 cpm. The measurements are represented in Figures A-21 and A-22.

**Background Locations**

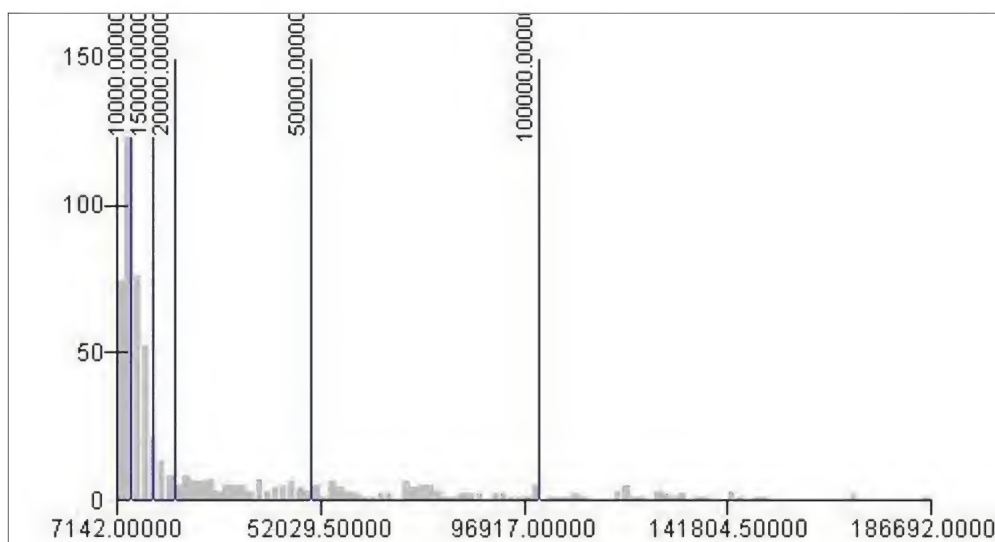
**Average background = 7,905 cpm**

#1 8,497 cpm

#2 7,312 cpm

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	577
Minimum:	7142.00000
Maximum:	186692.00000
Sum:	16770340.00000
Mean:	29064.71404
Median:	12476.00000
Standard Deviation:	33567.95094



Photo 1. Upper Salt Rock (16) site



Photo 2. Upper Salt Rock (16) site



Photo 3. Upper Salt Rock (16) site

**Site:** VCA Plot 7

**Mine ID:** 18

**Highest gamma radiation measurement:**

224,092 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 5,107 gamma radiation measurements were collected from the mine site, ranging from 5,327 cpm to 224,092 cpm. The measurements are represented in Figures A-23 and A-24.

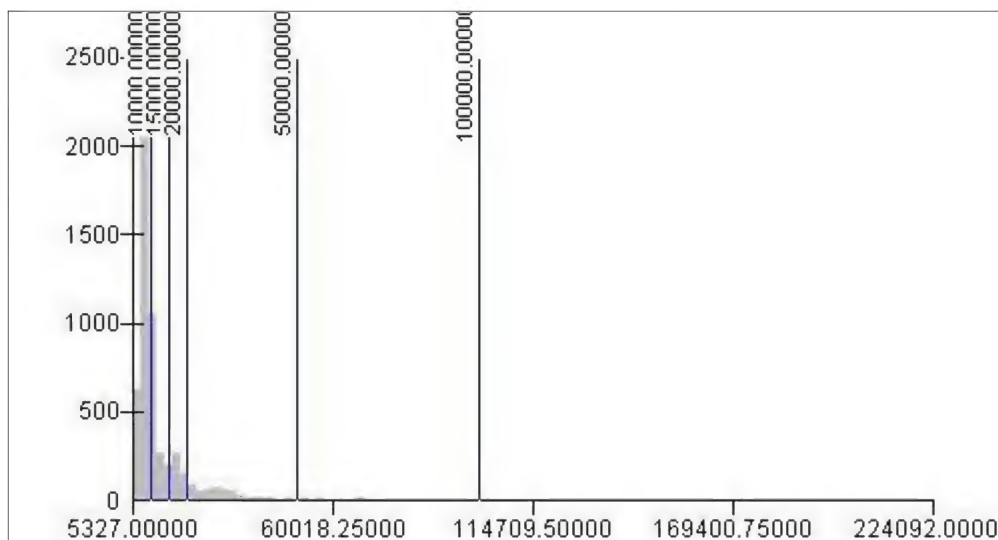
**Background Locations**

#1 10,169 cpm

**Average background = 10,169 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	5107
Minimum:	5327.00000
Maximum:	224092.00000
Sum:	66412129.00000
Mean:	13004.13726
Median:	9562.00000
Standard Deviation:	13334.56855



Photo 1. VCA Plot 7 (18) site



Photo 2. VCA Plot 7 (18) site



Photo 3. VCA Plot 7 (18) site



Photo 4. VCA Plot 7 (18) site



Photo 5. VCA Plot 7 (18) site

**Site:** Oak Springs Mine (Gravel Cap)

**Mine ID:** 20

**Highest gamma radiation measurement:**

33,350 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 3,771 gamma radiation measurements were collected from the mine site, ranging from 6,019 cpm to 33,350 cpm. The measurements are represented in Figures A-25 and A-26.

**Background Locations**

**Average background = 8,089 cpm**

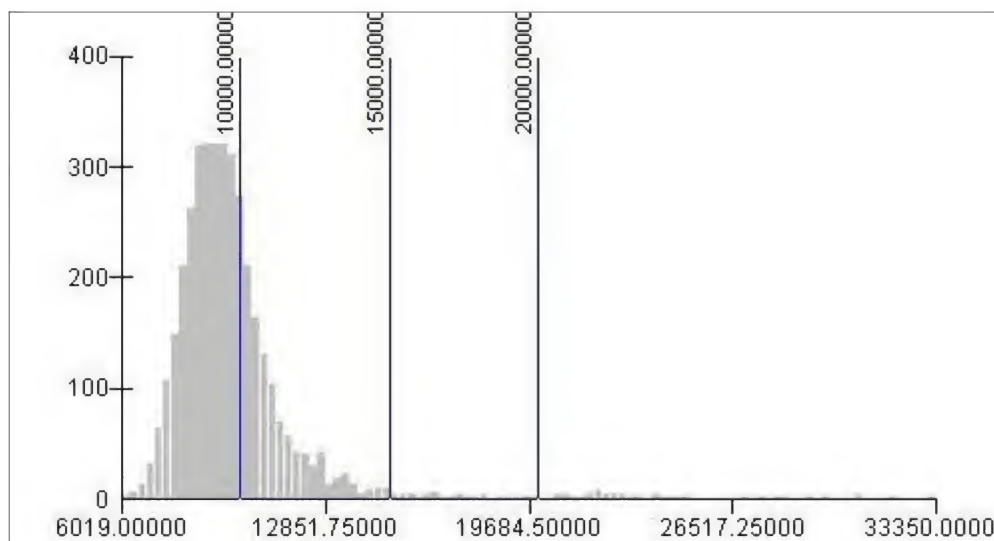
#1 7,299 cpm

#2 8,736 cpm

#3 8,232 cpm

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	3771
Minimum:	6019.00000
Maximum:	33350.00000
Sum:	36902412.00000
Mean:	9785.84248
Median:	9381.00000
Standard Deviation:	2369.18305



Photo 1. Oak Springs Mine (Gravel Cap) (20) site



Photo 2. Oak Springs Mine (Gravel Cap) (20) site



Photo 3. Oak Springs Mine (Gravel Cap) (20) site



Photo 4. Oak Springs Mine (Gravel Cap) (20) site

**Site:** Red Wash (Hosteen S. Begay)

**Mine ID:** 30

**Highest gamma radiation measurement:**

41,105 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 3,919 gamma radiation measurements were collected from the mine site, ranging from 6,991 cpm to 41,105 cpm. The measurements are represented in Figures A-27 and A-28.

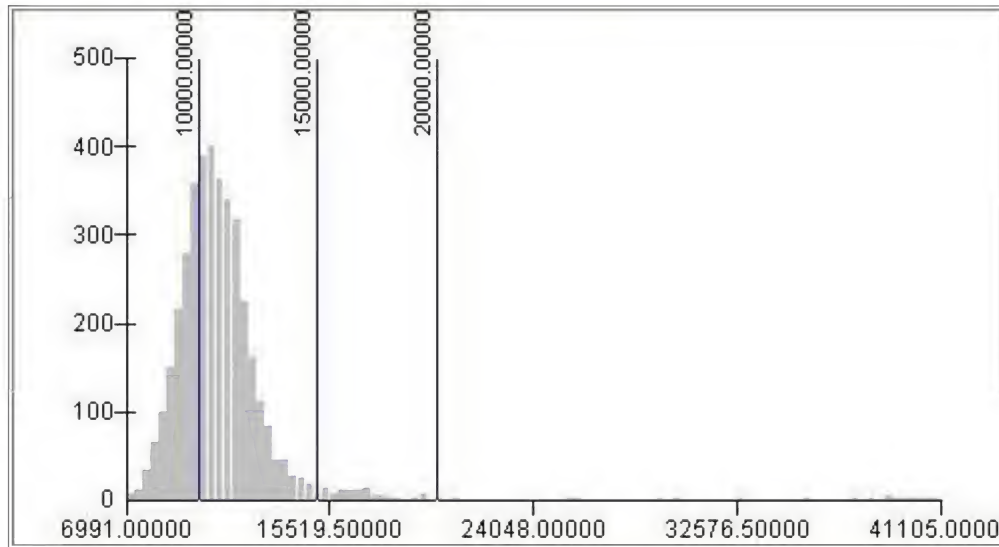
**Background Locations**

#1 11,267 cpm

**Average background = 11,267 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	3919
Minimum:	6991.00000
Maximum:	41105.00000
Sum:	43777748.00000
Mean:	11170.64251
Median:	10702.00000
Standard Deviation:	3138.98986



Photo 1. Red Wash (Hosteen S. Begay) (30) site



Photo 2. Red Wash (Hosteen S. Begay) (30) site



Photo 3. Red Wash (Hosteen S. Begay) (30) site

**Site:** VCA Plot 7

**Mine ID:** 41

**Highest gamma radiation measurement:**

20,665 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 1,553 gamma radiation measurements were collected from the mine site, ranging from 6,125 cpm to 20,665 cpm. The measurements are represented in Figures A-23 and A-24.

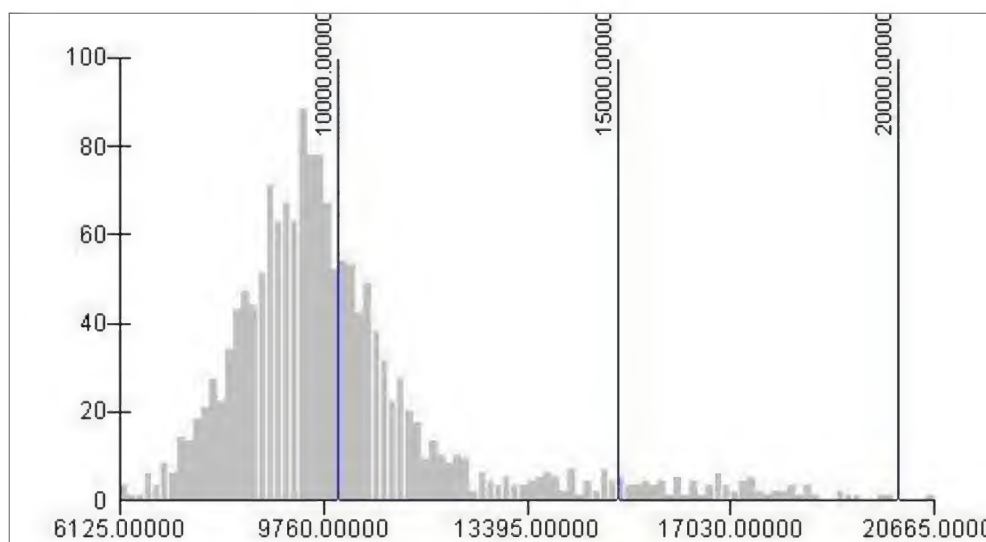
**Background Locations**

#1 8,526 cpm

**Average background = 8,526 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1553
Minimum:	6125.00000
Maximum:	20665.00000
Sum:	15585877.00000
Mean:	10035.98004
Median:	9596.00000
Standard Deviation:	2144.89692



Photo 1. VCA Plot 7 (41) site



Photo 2. VCA Plot 7 (41) site



Photo 3. VCA Plot 7 (41) site

**Site:** Red Rock

**Mine ID:** 42

**Highest gamma radiation measurement:**

23,240 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 594 gamma radiation measurements were collected from the mine site, ranging from 6,105 cpm to 23,240 cpm. The measurements are represented in Figures A-29 and A-30.

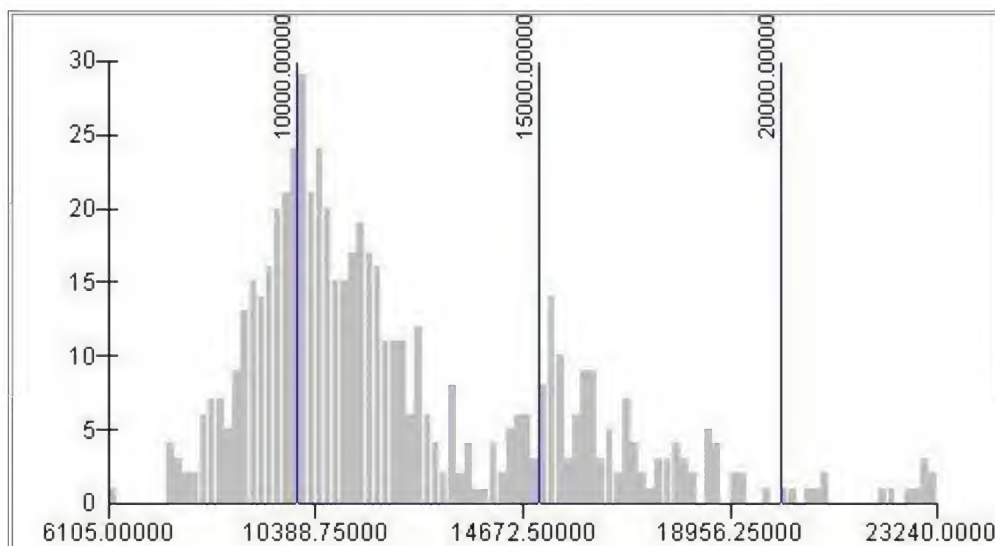
**Background Locations**

#1 6,455 cpm

**Average background = 6,455 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	594
Minimum:	6105.00000
Maximum:	23240.00000
Sum:	7186319.00000
Mean:	12098.18013
Median:	11147.50000
Standard Deviation:	3162.78151



Photo 1. Red Rock (42) site



Photo 2. Red Rock (42) site

**Site:** NA-0828

**Mine ID:** 43

**Highest gamma radiation measurement:**

19,202 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 480 gamma radiation measurements were collected from the mine site, ranging from 5,786 cpm to 19,202 cpm. The measurements are represented in Figures A-31 and A-32.

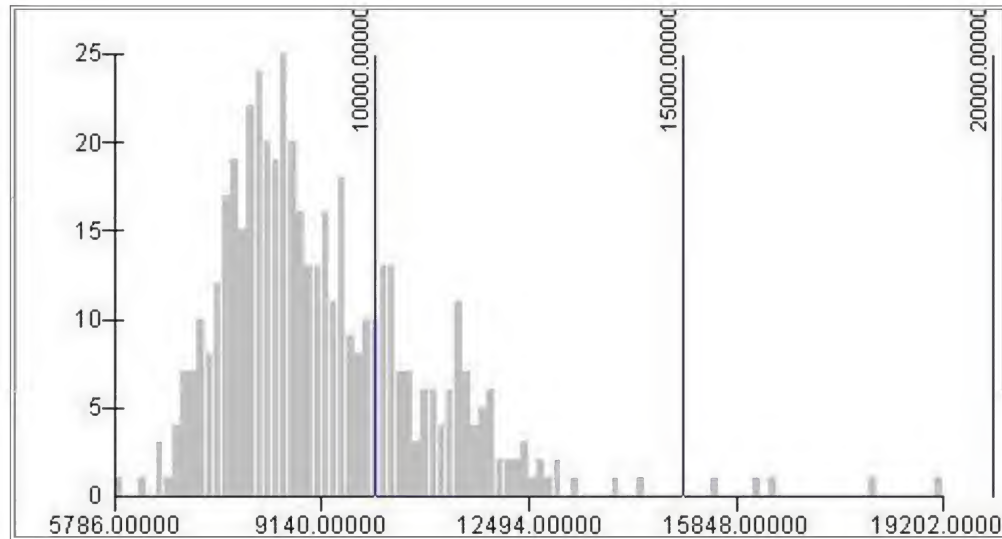
**Background Locations**

#1 10,512 cpm

**Average background = 10,512 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	480
Minimum:	5786.00000
Maximum:	19202.00000
Sum:	4403180.00000
Mean:	9173.29167
Median:	8811.50000
Standard Deviation:	1671.44467



Photo 1. NA-0828 (43) site

**Site:** Lower Salt Rock

**Mine ID:** 289

**Highest gamma radiation measurement:**

309,248 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 1,096 gamma radiation measurements were collected from the mine site, ranging from 6,127 cpm to 309,248 cpm. The measurements are represented in Figures A-33 and A-34.

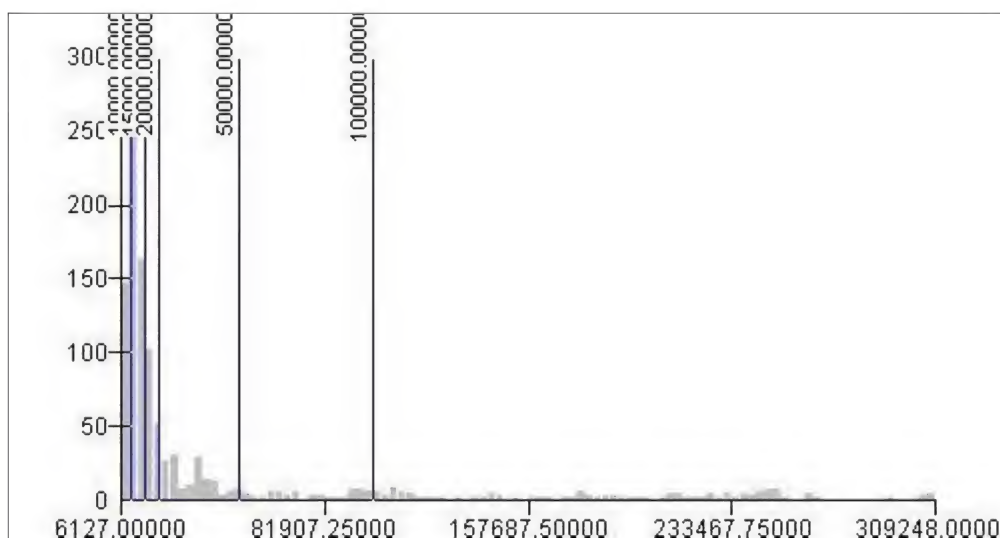
**Background Locations**

#1 9,621 cpm

**Average background = 9,621 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1096
Minimum:	6127.00000
Maximum:	309248.00000
Sum:	45178861.00000
Mean:	41221.58850
Median:	13699.00000
Standard Deviation:	63788.55993



Photo 1. Lower Salt Rock (289) site



Photo 2. Lower Salt Rock (289) site



Photo 3. Lower Salt Rock (289) site



Photo 4. Lower Salt Rock (289) site



Photo 5. Lower Salt Rock (289) site



Photo 6. Lower Salt Rock (289) site

**Site:** Oak238

**Mine ID:** 440

**Highest gamma radiation measurement:**

288,702 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 1,930 gamma radiation measurements were collected from the mine site, ranging from 5,557 cpm to 288,702 cpm. The measurements are represented in Figures A-23 and A-24.

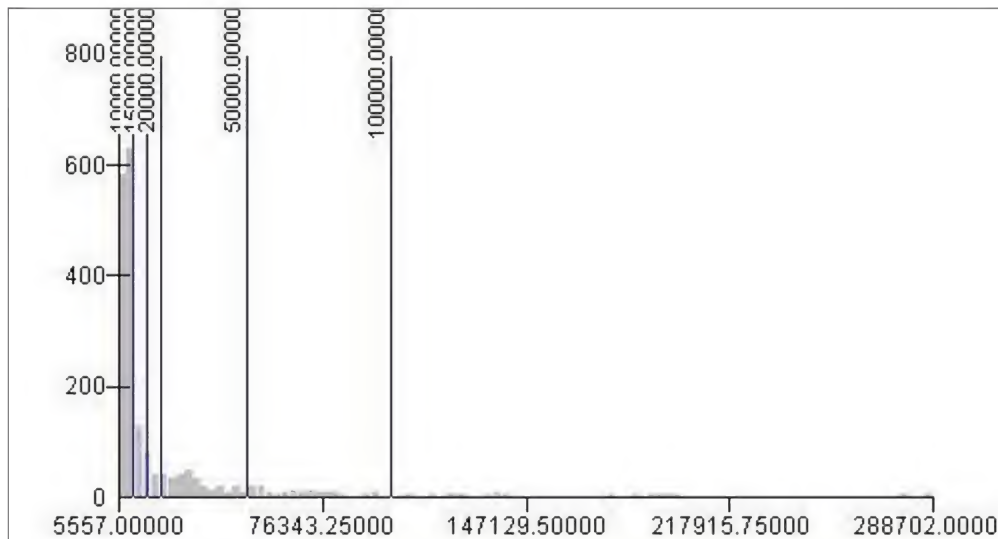
**Background Locations**

#1 8,979 cpm

**Average background = 8,979 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1930
Minimum:	5557.00000
Maximum:	288702.00000
Sum:	42840146.00000
Mean:	22196.96684
Median:	9698.50000
Standard Deviation:	34339.59694



Photo 1. Oak238 (440) site



Photo 2. Oak238 (440) site



Photo 3. Oak238 (440) site



Photo 4. Oak238 (440) site

**Site:** Oak 230

**Mine ID:** 441

**Highest gamma radiation measurement:**

37,578 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 1,086 gamma radiation measurements were collected from the mine site, ranging from 6,924 cpm to 37,578 cpm. The measurements are represented in Figures A-35 and A-36.

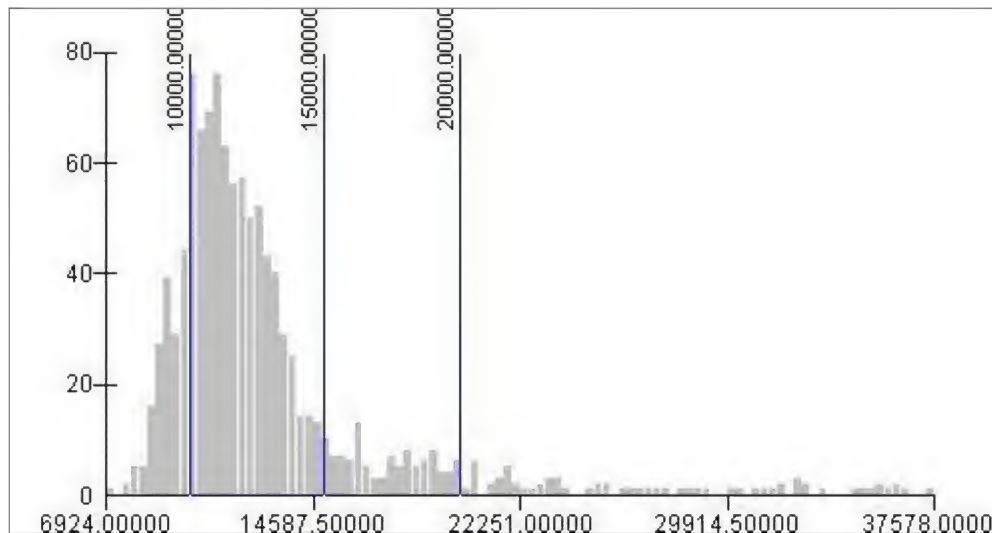
**Background Locations**

#1 8,386 cpm

**Average background = 8,386 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1086
Minimum:	6924.00000
Maximum:	37578.00000
Sum:	14013716.00000
Mean:	12903.97422
Median:	11623.00000
Standard Deviation:	4501.07799



Photo 1. Oak230 (441) site



Photo 2. Oak230 (441) site



Photo 3. Oak230 (441) site

**Site:** Oak143, Oak146

**Mine ID:** 482

**Highest gamma radiation measurement:**

202,126 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 1,752 gamma radiation measurements were collected from the mine site, ranging from 9,896 cpm to 202,126 cpm. The measurements are represented in Figures A-37 and A-38.

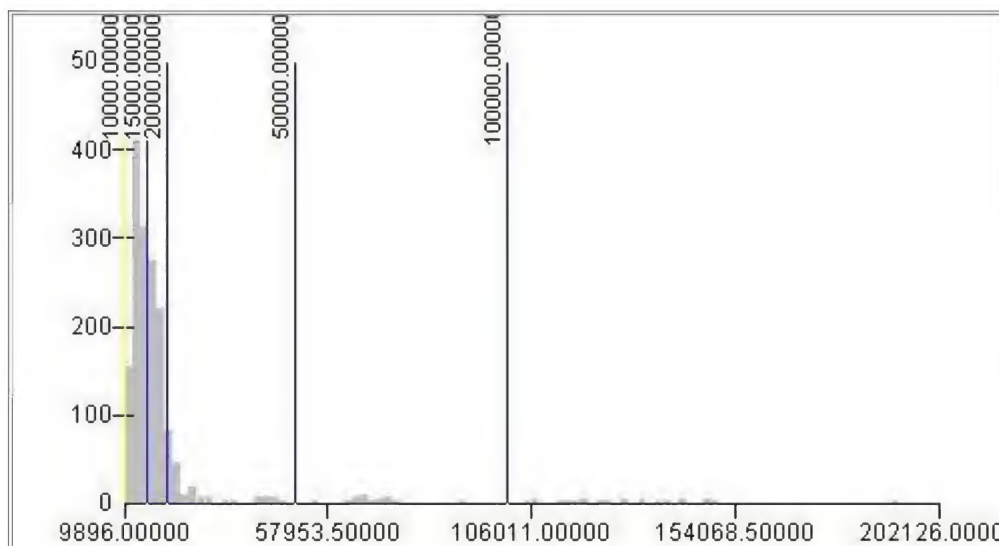
**Background Locations**

#1 12,932 cpm

**Average background = 12,932 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1752
Minimum:	9896.00000
Maximum:	202126.00000
Sum:	37593338.00000
Mean:	21457.38470
Median:	15087.50000
Standard Deviation:	24044.07757



Photo 1. Oak143, Oak146 (482) site



Photo 2. Oak143, Oak146 (482) site



Photo 3. Oak143, Oak146 (482) site



Photo 4. Oak143, Oak146 (482) site



Photo 5. Oak143, Oak146 (482) site



Photo 6. Oak143, Oak146 (482) site

**Site:** Oak124, Oak125

**Mine ID:** 486

**Highest gamma radiation measurement:**

107,107 counts per minute (cpm)

**Describe any other radiological measurements:**

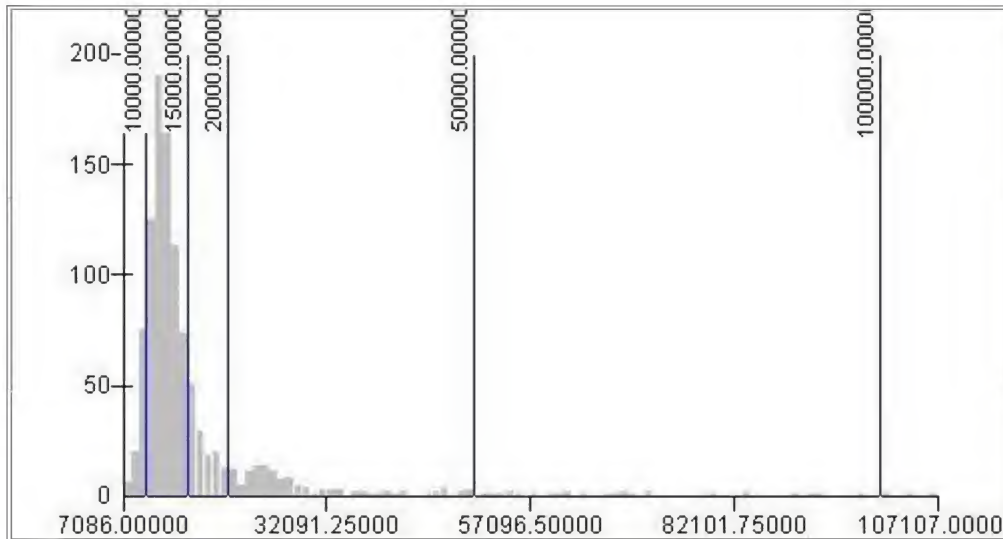
A total of 1,055 gamma radiation measurements were collected from the mine site, ranging from 7,086 cpm to 107,107 cpm. The measurements are represented in Figures A-39 and A-40.

**Background Locations**  
#9,459 cpm

**Average background = 9,459 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1055
Minimum:	7086.00000
Maximum:	107107.00000
Sum:	17061734.00000
Mean:	16172.25972
Median:	12722.00000
Standard Deviation:	11615.85905



Photo 1. Oak124, Oak125 (486) site



Photo 2. Oak124, Oak125 (486) site



Photo 3. Oak124, Oak125 (486) site

**Site:** King Tutt Point

**Mine ID:** 487

**Highest gamma radiation measurement:**

97,141 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 2,256 gamma radiation measurements were collected from the mine site, ranging from 7,571 cpm to 97,141 cpm. The measurements are represented in Figures A-41 and A-42.

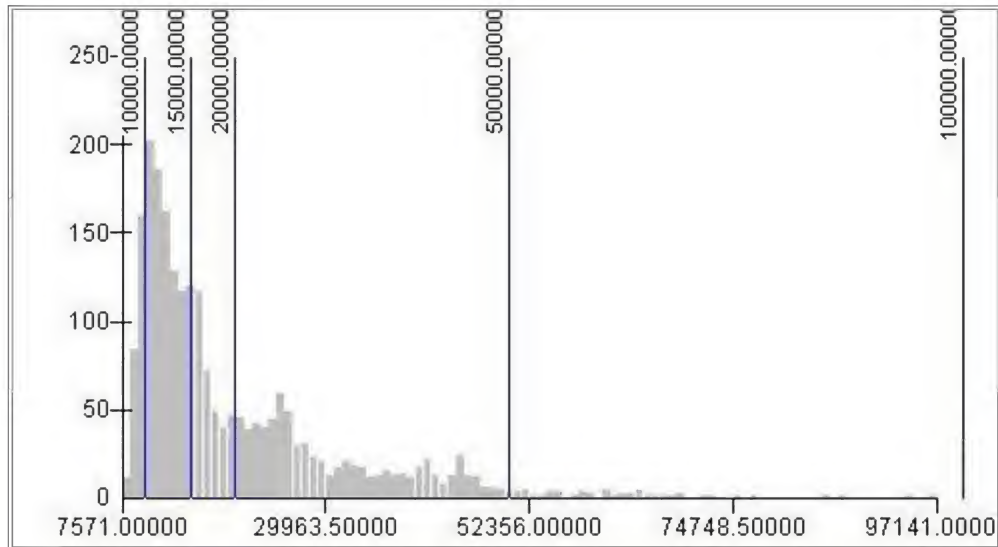
**Background Locations**

#1 9,487 cpm

**Average background = 9,487 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	2256
Minimum:	7571.00000
Maximum:	97141.00000
Sum:	44540181.00000
Mean:	19742.98803
Median:	15317.50000
Standard Deviation:	11650.90890



Photo 1. King Tutt Point (487) site



Photo 2. King Tutt Point (487) site



Photo 3. King Tutt Point (487) site



Photo 4. King Tutt Point (487) site



Photo 5. King Tutt Point (487) site



Photo 6. King Tutt Point (487) site

**Site:** Carrizo No. 1

**Mine ID:** 488

**Highest gamma radiation measurement:**

29,904 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 415 gamma radiation measurements were collected from the mine site, ranging from 11,413 cpm to 29,904 cpm. The measurements are represented in Figures A-43 and A-44.

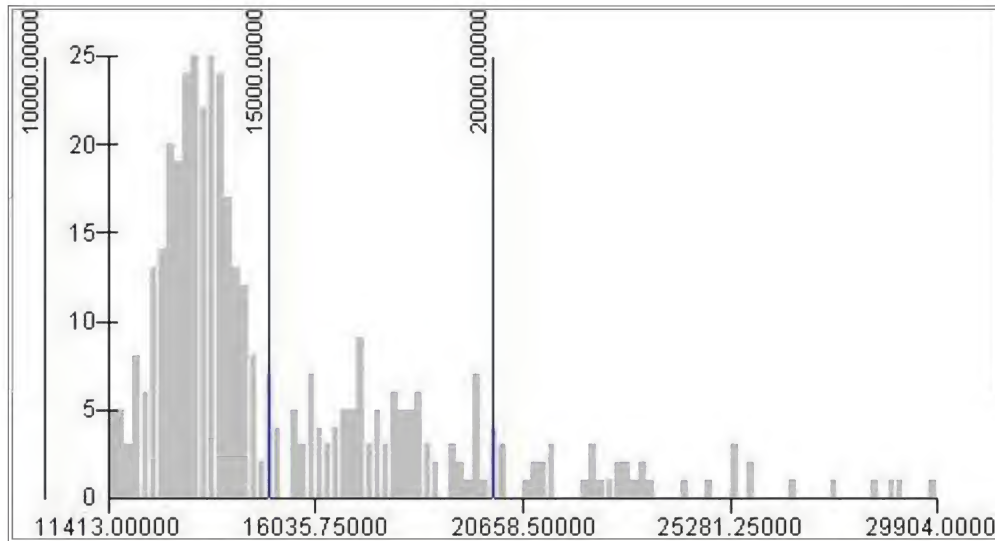
**Background Locations**

#1 10,154 cpm

**Average background = 10,154 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	415
Minimum:	11413.00000
Maximum:	29904.00000
Sum:	6367618.00000
Mean:	15343.65783
Median:	13950.00000
Standard Deviation:	3371.60660



Photo 1. Carrizo No. 1 (488) site



Photo 2. Carrizo No. 1 (488) site

**Site:** King Tutt 1

**Mine ID:** 640

**Highest gamma radiation measurement:**

143,999 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 1,877 gamma radiation measurements were collected from the mine site, ranging from 6,568 cpm to 143,999 cpm. The measurements are represented in Figures A-5 and A-6.

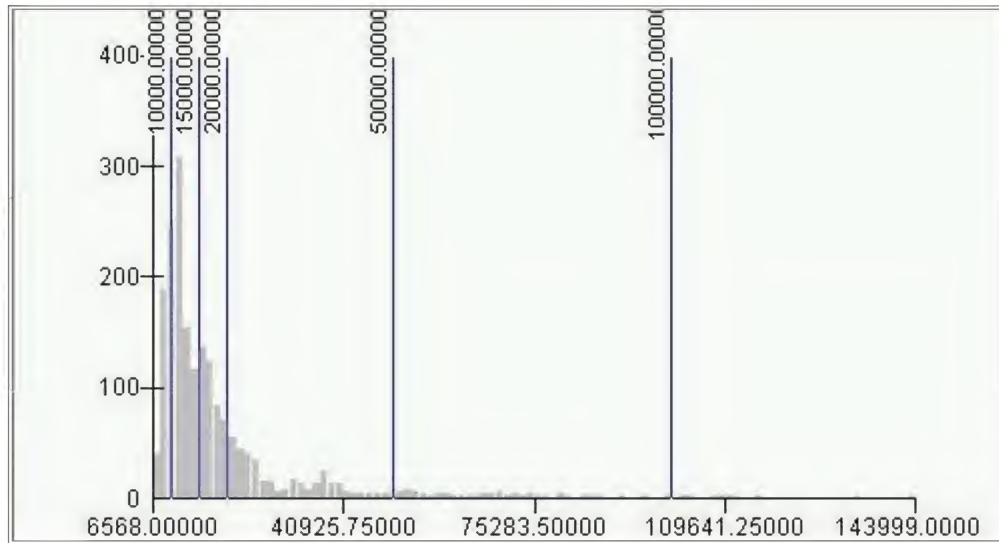
**Background Locations**

#1 10,567 cpm

**Average background = 10,567 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1877
Minimum:	6568.00000
Maximum:	143999.00000
Sum:	34109494.00000
Mean:	18172.34630
Median:	13501.00000
Standard Deviation:	14296.58060



Photo 1. King Tutt 1 (640) site



Photo 2. King Tutt 1 (640) site



Photo 3. King Tutt 1 (640) site



Photo 4. King Tutt 1 (640) site



Photo 5. King Tutt 1 (640) site



Photo 6. King Tutt 1 (640) site



Photo 7. King Tutt 1 (640) site

**Site:** VCA Plot 3

**Mine ID:** 641

**Highest gamma radiation measurement:**

42,644 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 3,069 gamma radiation measurements were collected from the mine site, ranging from 8,259 cpm to 42,644 cpm. The measurements are represented in Figures A-45 and A-46.

**Background Locations**

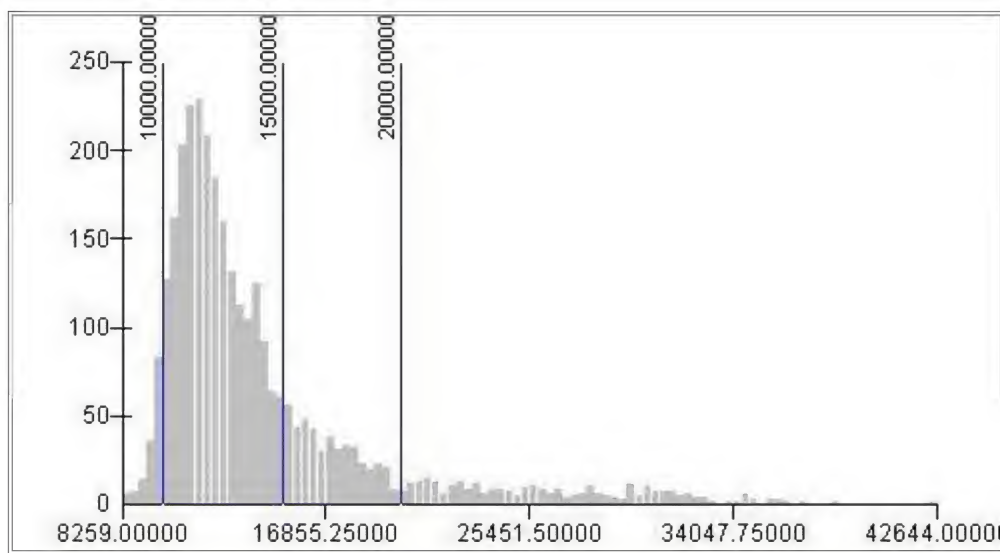
**Average background = 13,516 cpm**

#1 13,021 cpm

#1 14,009 cpm

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	3069
Minimum:	8259.00000
Maximum:	42644.00000
Sum:	43312642.00000
Mean:	14112.94949
Median:	12519.00000
Standard Deviation:	4768.12229



Photo 1. VCA Plot 3 (641) site



Photo 2. VCA Plot 3 (641) site



Photo 3. VCA Plot 3 (641) site



Photo 4. VCA Plot 3 (641) site

**Site:** Shadyside No. 2

**Mine ID:** 642

**Highest gamma radiation measurement:**

40,600 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 766 gamma radiation measurements were collected from the mine site, ranging from 7,158 cpm to 40,600 cpm. The measurements are represented in Figures A-45 and A-46.

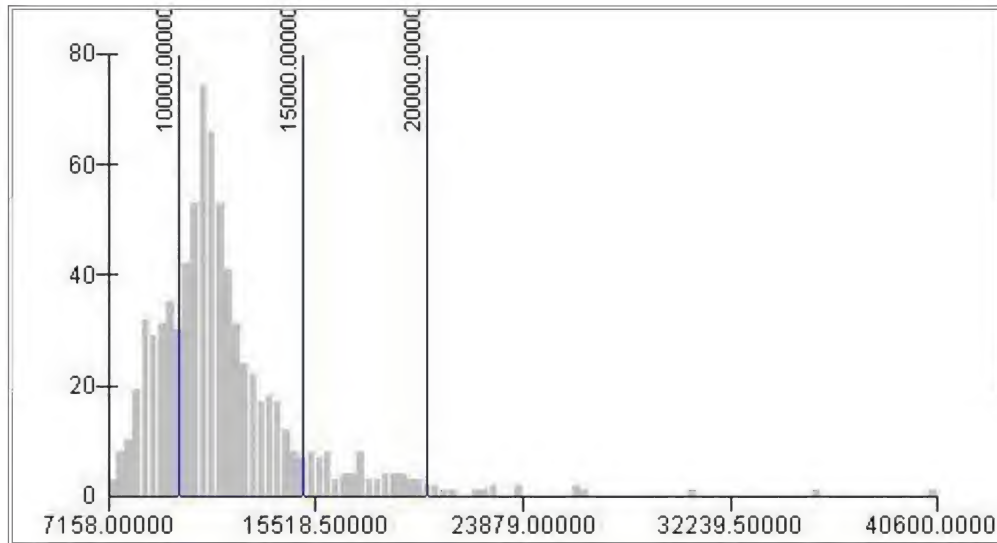
**Background Locations**

#1 8,333 cpm

**Average background = 8,333 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	766
Minimum:	7158.00000
Maximum:	40600.00000
Sum:	9118051.00000
Mean:	11903.46084
Median:	11247.50000
Standard Deviation:	3195.56220



Photo 1. Shadyside No. 2 (642) site



Photo 2. Shadyside No. 2 (642) site



Photo 3. Shadyside No. 2 (642) site

Site: VCA Plot 3

Mine ID: 643

**Highest gamma radiation measurement:**

102,116 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 2,651 gamma radiation measurements were collected from the mine site, ranging from 6,641 cpm to 102,116 cpm. The measurements are represented in Figures A-45 and A-46.

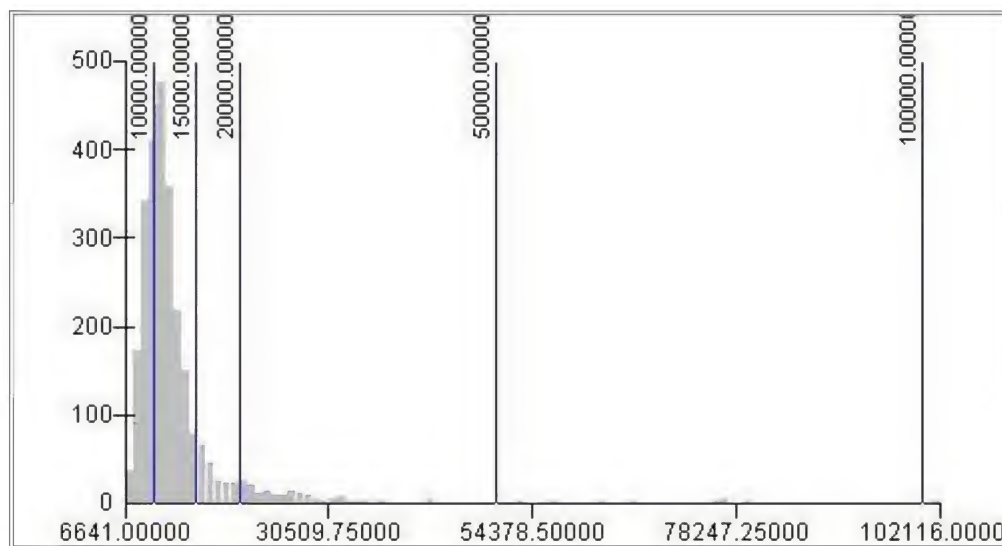
**Background Locations**

#1 9,776 cpm

**Average background = 9,776 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	2651
Minimum:	6641.00000
Maximum:	102116.00000
Sum:	34726095.00000
Mean:	13099.24368
Median:	11117.00000
Standard Deviation:	8820.38013



Photo 1. VCA Plot 3 (643) site



Photo 1. VCA Plot 3 (643) site

**Site:** Begay Incline

**Mine ID:** 652

**Highest gamma radiation measurement:**

25,285 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 1,152 gamma radiation measurements were collected from the mine site, ranging from 6,698 cpm to 25,285 cpm. The measurements are represented in Figures A-13 and A-14.

**Background Locations**

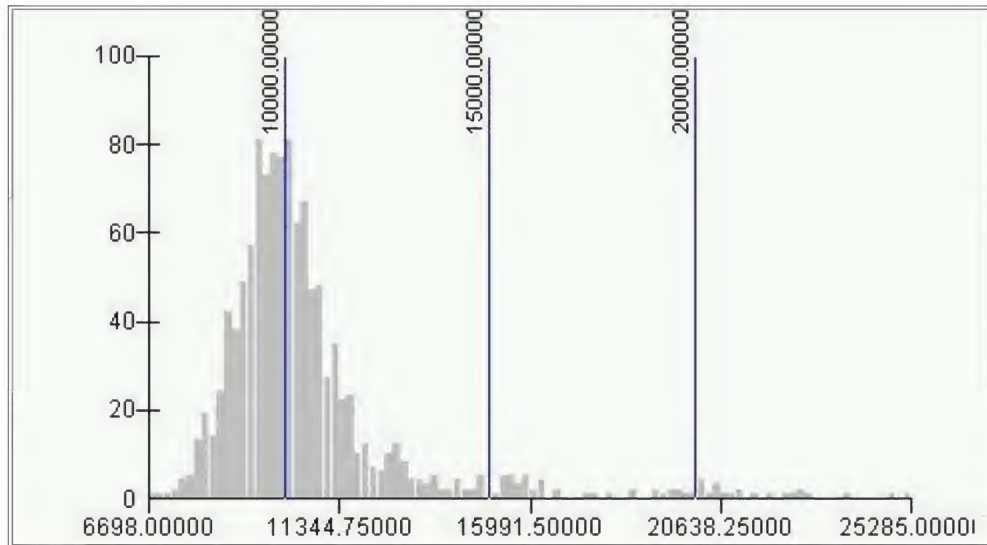
**Average background = 9,783 cpm**

#1 9,007 cpm

#2 10,558 cpm

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



Count:	1152
Minimum:	6698.00000
Maximum:	25285.00000
Sum:	12165100.00000
Mean:	10559.98264
Median:	10036.50000
Standard Deviation:	2363.16382



Photo 1. Begay Incline (652) site



Photo 2. Begay Incline (652) site



Photo 3. Begay Incline (652) site

**Site:** Begay No. 1

**Mine ID:** 659

**Highest gamma radiation measurement:**

85,684 counts per minute (cpm)

**Describe any other radiological measurements:**

A total of 492 gamma radiation measurements were collected from the mine site, ranging from 10,380 cpm to 85,684 cpm. The measurements are represented in Figures A-43 and A-44.

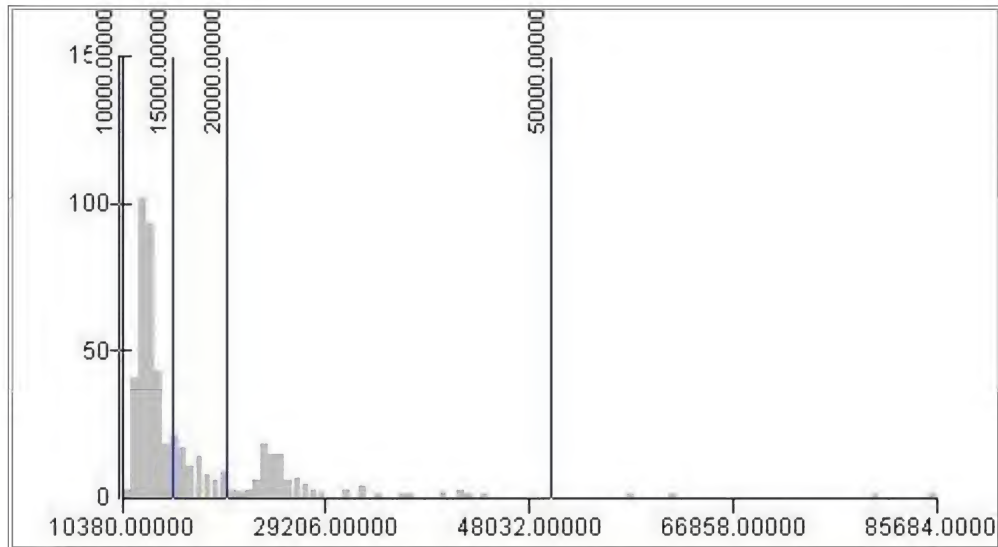
**Background Locations**

#1 9,459 cpm

**Average background = 9,459 cpm**

**Distribution Chart and Statistics:**

The following chart and statistics were generated by ESRI ArcGIS 9.3.1, and show the general distribution of the site gamma radiation measurements. The horizontal X axis represents the gamma radiation reading levels in cpm (lowest levels to the left). The vertical Y axis represents the frequency of each gamma radiation level.



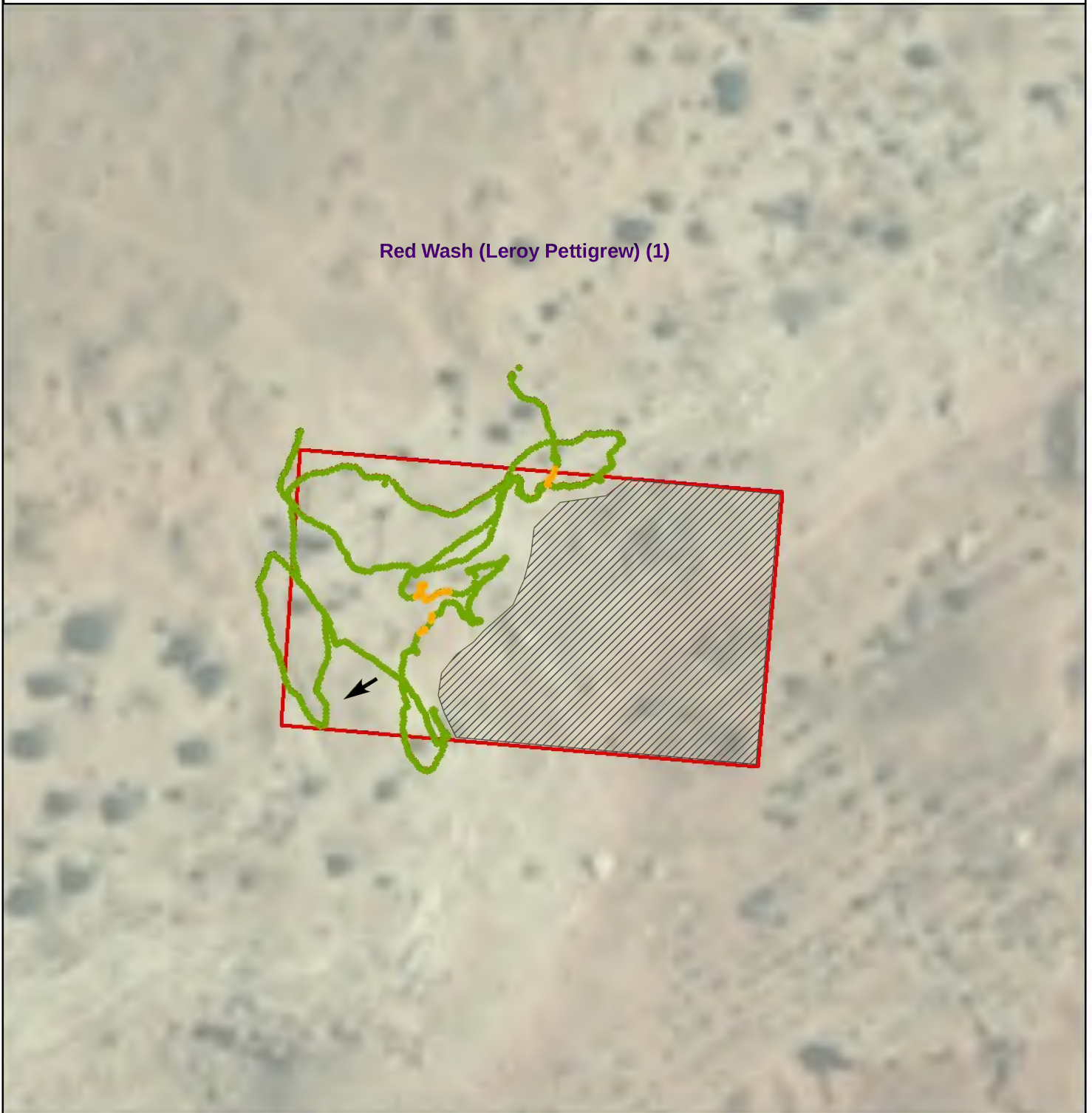
Count:	492
Minimum:	10380.00000
Maximum:	85684.00000
Sum:	8280132.00000
Mean:	16829.53659
Median:	13496.00000
Standard Deviation:	7832.73360



Photo 1. Begay No. 1 (659) site

**Attachment A:  
2010 Gamma Radiation Survey Maps**

**Figure A-1 - Gamma Radiation Measurements, Above Two Times Background  
Red Wash (Leroy Pettigrew) (1)  
Red Valley Chapter, Navajo Nation**



### Legend

#### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

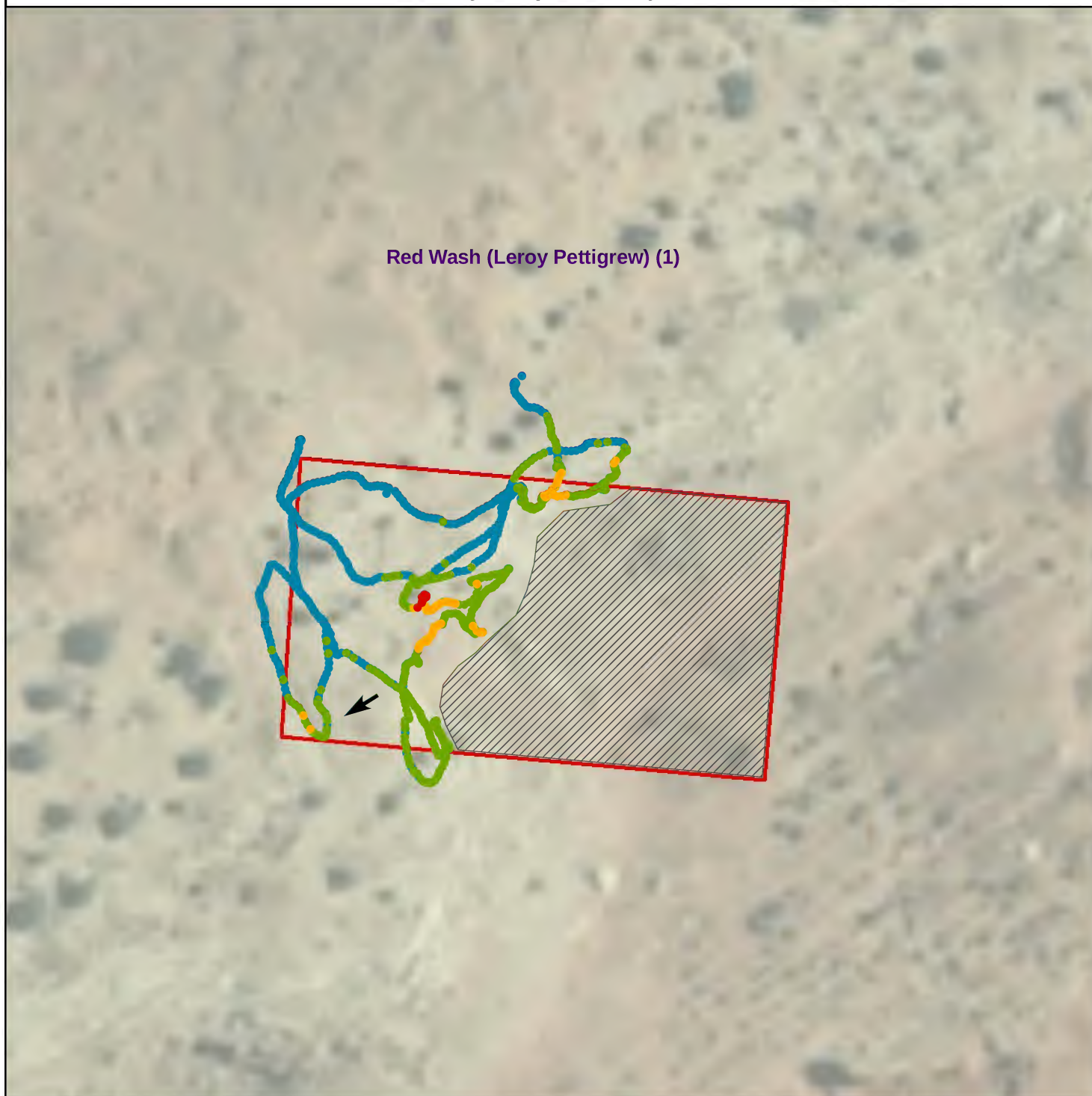
- ➔ General Direction Down-Slope
- ▭ Mine Claim Boundaries
- ▨ Inaccessible due to steep grades

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 8,386 cpm



Figure A-2 - Gamma Radiation Measurements  
 Red Wash (Leroy Pettigrew) (1)  
 Red Valley Chapter, Navajo Nation



### Legend

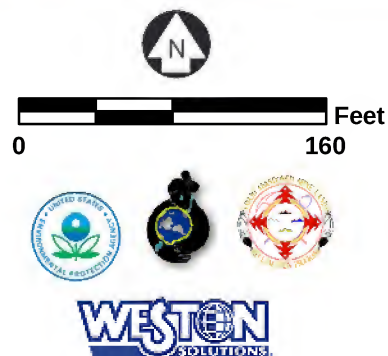
#### Gamma Radiation Measurements

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000

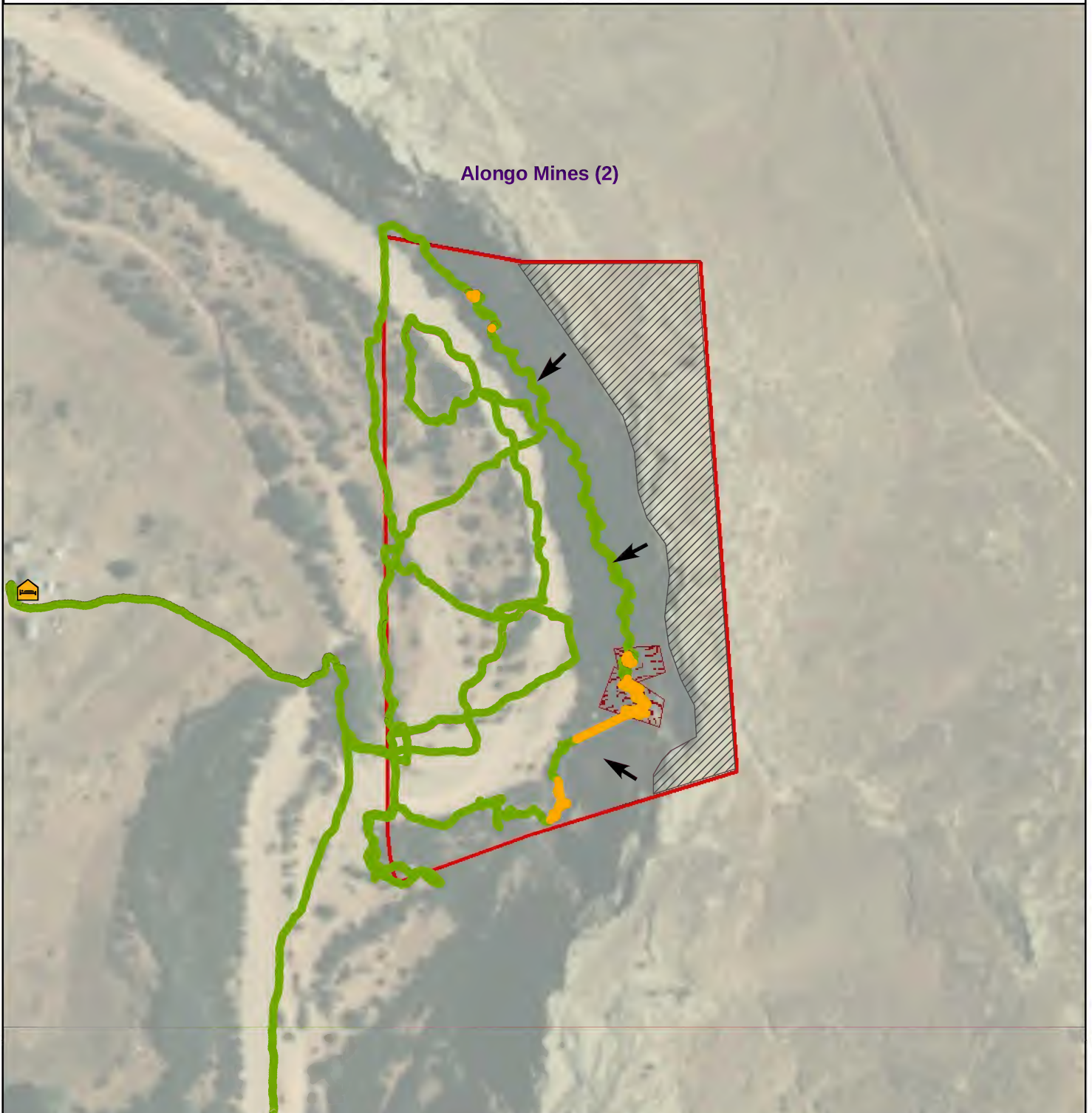
- ➔ General Direction Down-Slope
- ▭ Mine Claim Boundaries
- ▨ Inaccessible due to steep grades

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background 8,386 cpm



**Figure A-3 - Gamma Radiation Measurements, Above Two Times Background  
Along Mines (2)  
Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- < 2X Background
- > 2X Background

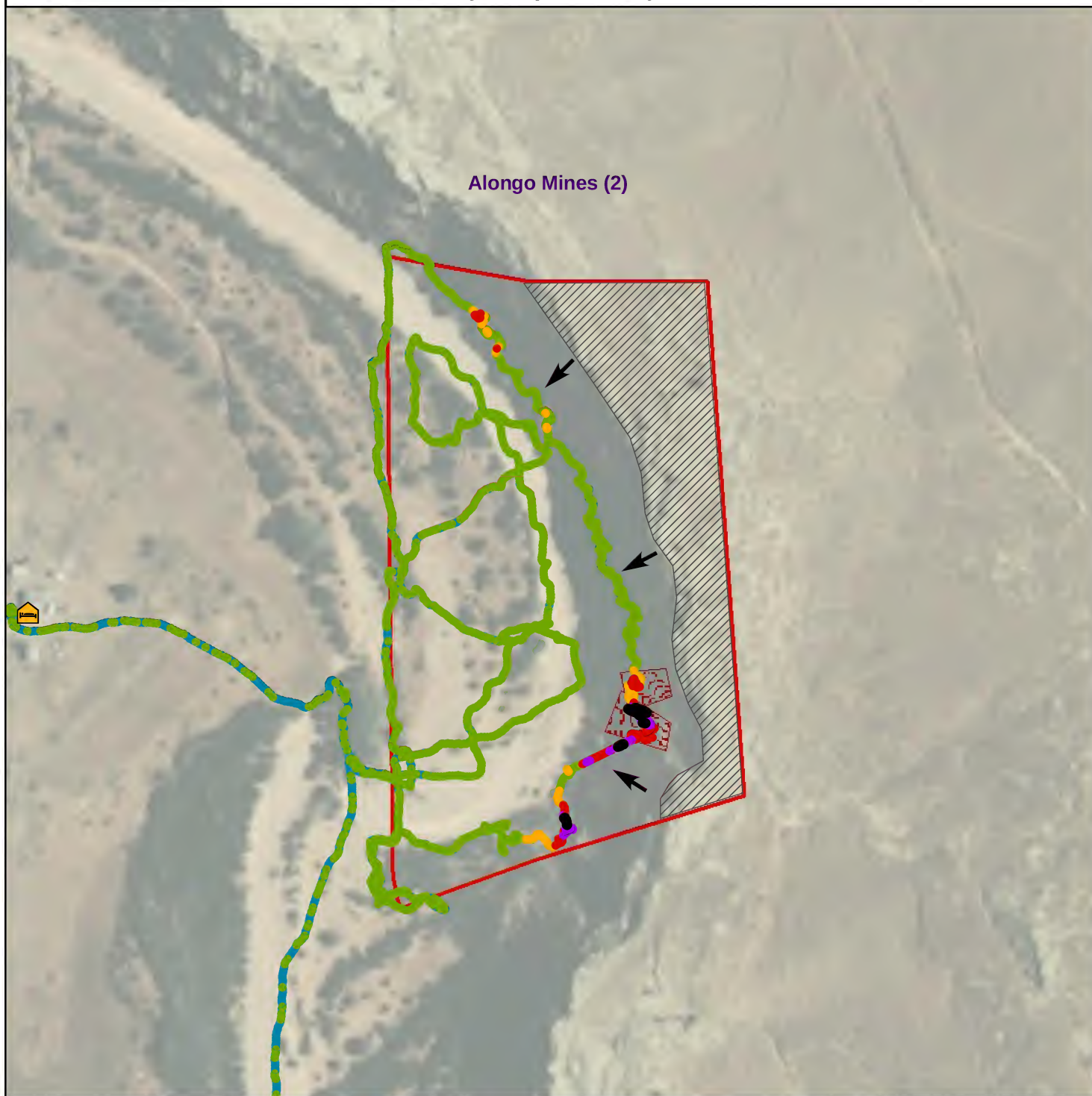
Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 10,310 cpm

- Observed Housing Structure
- Observed Waste Pile
- General Direction Down-Slope
- Mine Claim Boundaries
- Inaccessible due to steep grades



**Figure A-4 - Gamma Radiation Measurements  
Along Mines (2)  
Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



Observed Housing Structure



Observed Waste Pile



General Direction Down-Slope



Mine Claim Boundaries



Inaccessible due to steep grades

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background 10,310 cpm

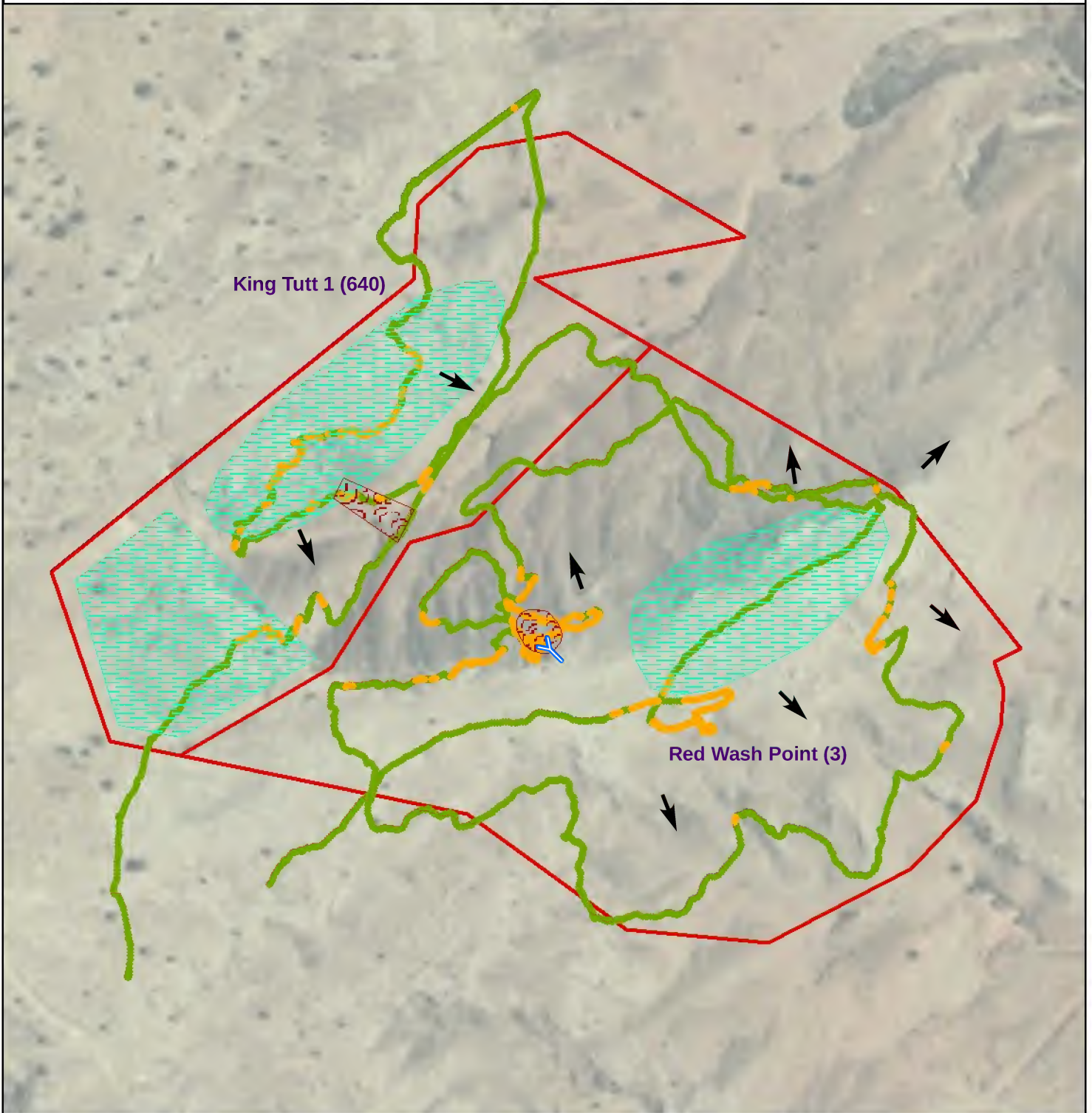


0 320 Feet



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**Figure A-5 - Gamma Radiation Measurements, Above Two Times Background  
Red Wash Point and King Tutt 1 (3, 640)  
Red Valley Chapter, Navajo Nation**



### Legend

#### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

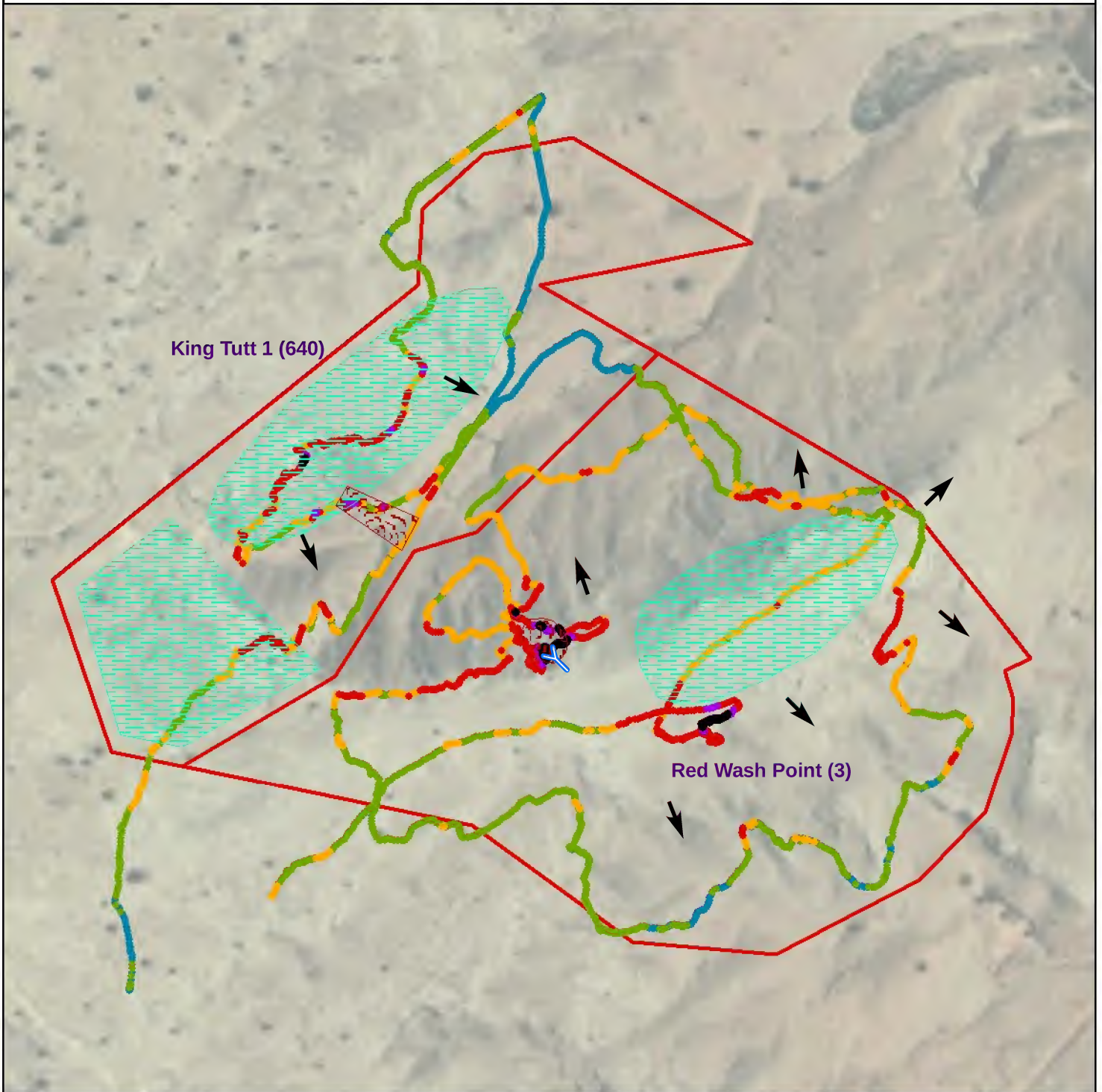
Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 10,567 cpm

- Observed Adit
- Observed Waste Pile
- General Direction Down-Slope
- Mine Claim Boundaries
- Observed Reclamation Cap



**Figure A-6 - Gamma Radiation Measurements  
Red Wash Point and King Tutt 1 (3, 640)  
Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



Observed Adit



Observed Waste Pile



General Direction Down-Slope



Mine Claim Boundaries



Observed Reclamation Cap

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background 10,567 cpm

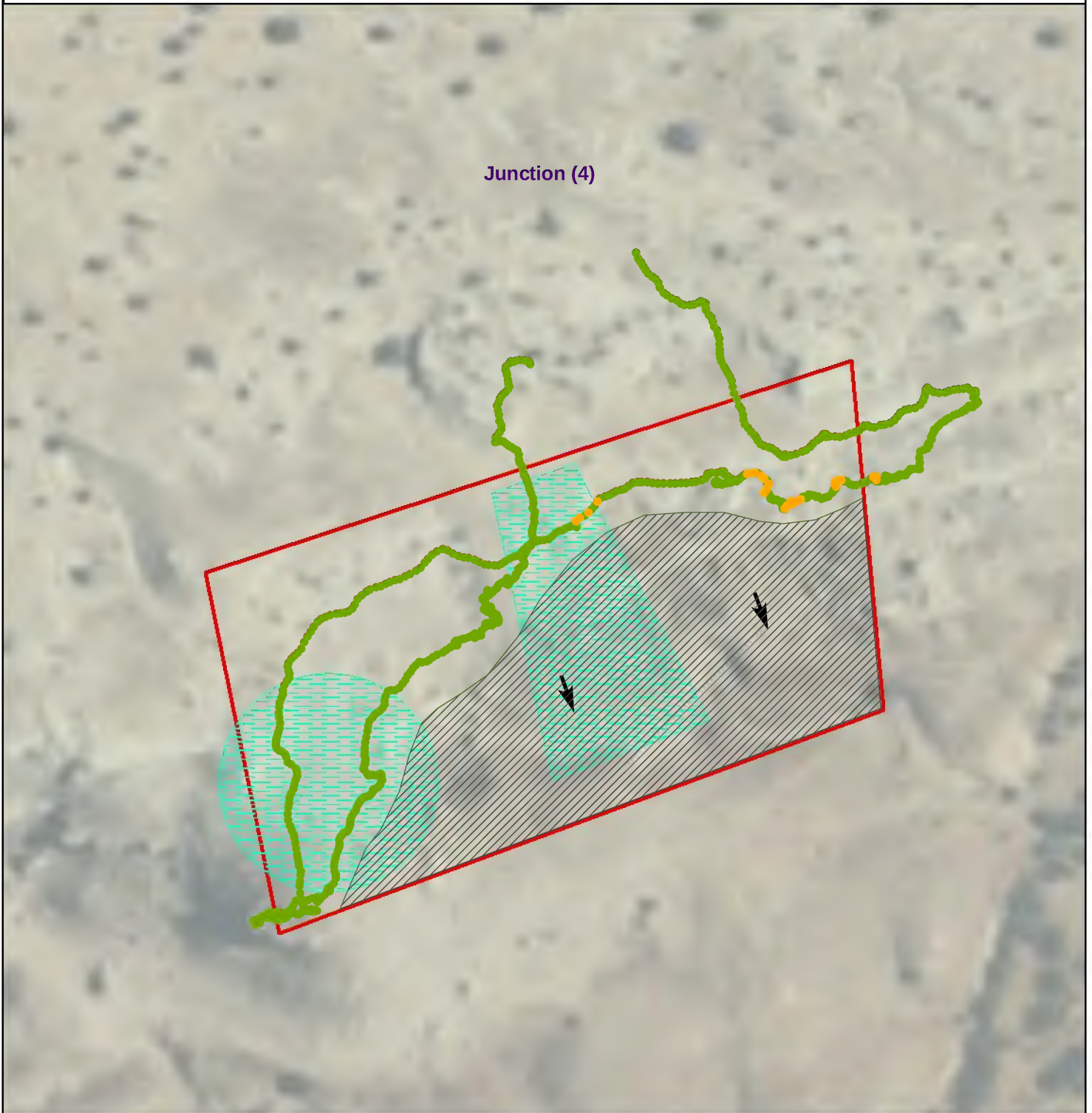


0 320 Feet



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**Figure A-7 - Gamma Radiation Measurements, Above Two Times Background  
Junction (4)  
Red Valley Chapter, Navajo Nation**







**Legend**

**Gamma Radiation Measurements**

- < 2X Background
- > 2X Background

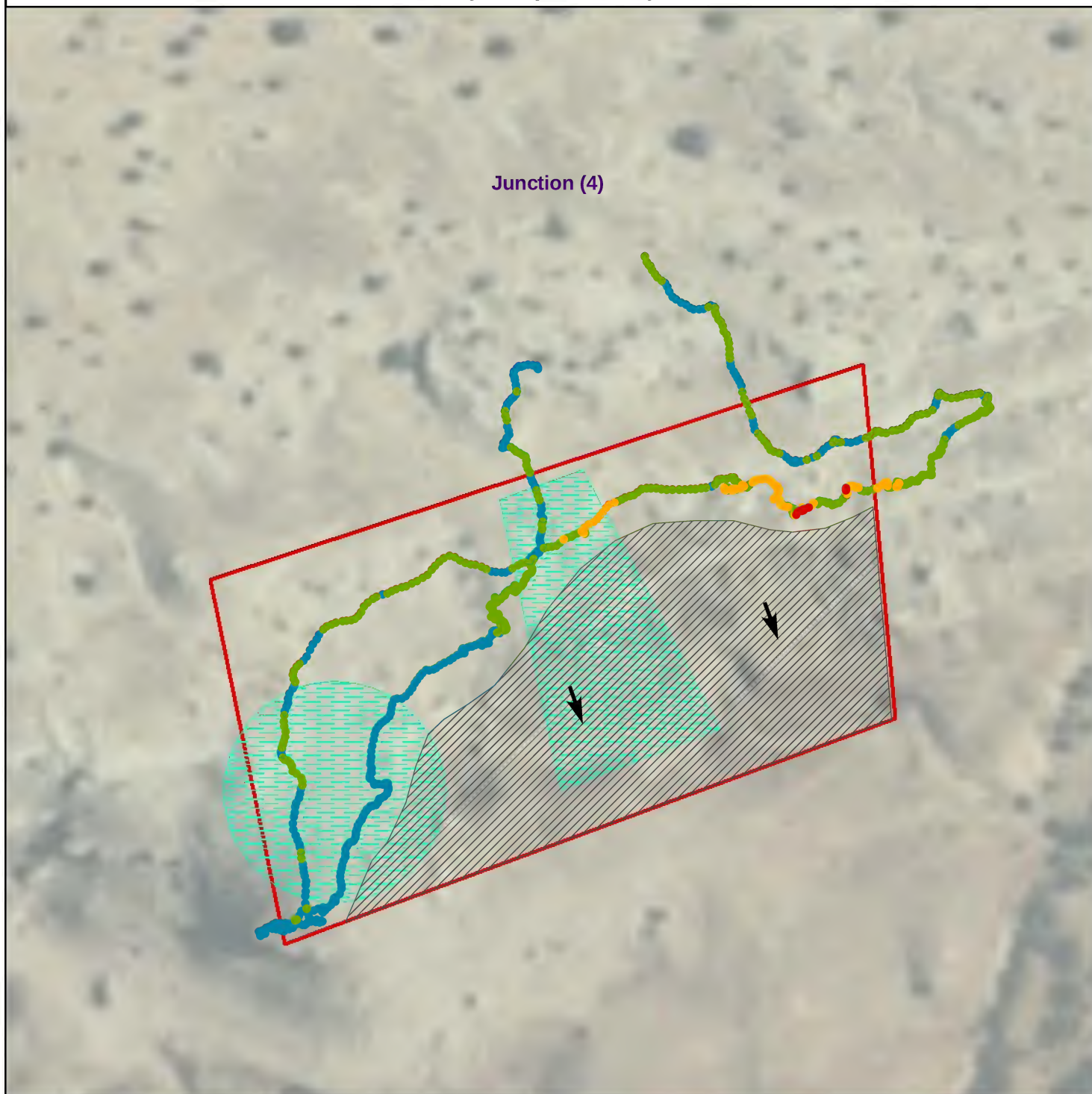
Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 8,229 cpm

-  Observed Reclamation Cap
-  General Direction Down-Slope
-  Mine Claim Boundaries
-  Inaccessible due to steep grades



**Figure A-8 - Gamma Radiation Measurements  
Junction (4)  
Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000

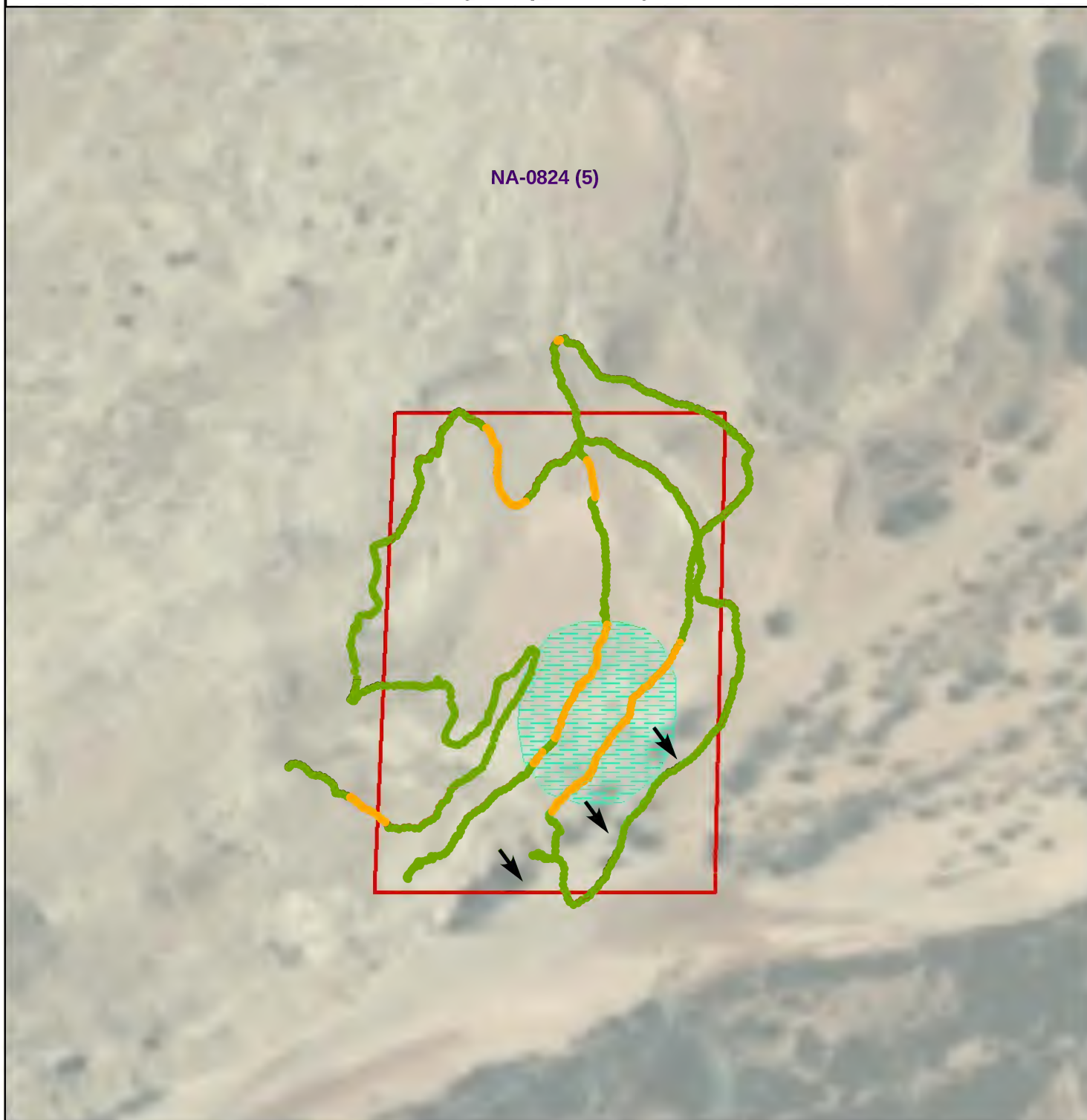
- Observed Reclamation Cap
- General Direction Down-Slope
- Mine Claim Boundaries
- Inaccessible due to steep grades

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background 8,229 cpm



**Figure A-9 - Gamma Radiation Measurements, Above Two Times Background**  
**NA-0824 (5)**  
**Red Valley Chapter, Navajo Nation**






## Legend

### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background = 8,666 cpm

-  Observed Reclamation Cap
-  General Direction Down-Slope
-  Mine Claim Boundaries



**Figure A-10 - Gamma Radiation Measurements**  
**NA-0824 (5)**  
**Red Valley Chapter, Navajo Nation**



### Legend

#### Gamma Radiation Measurements

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



Observed Reclamation Cap



General Direction Down-Slope



Mine Claim Boundaries

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

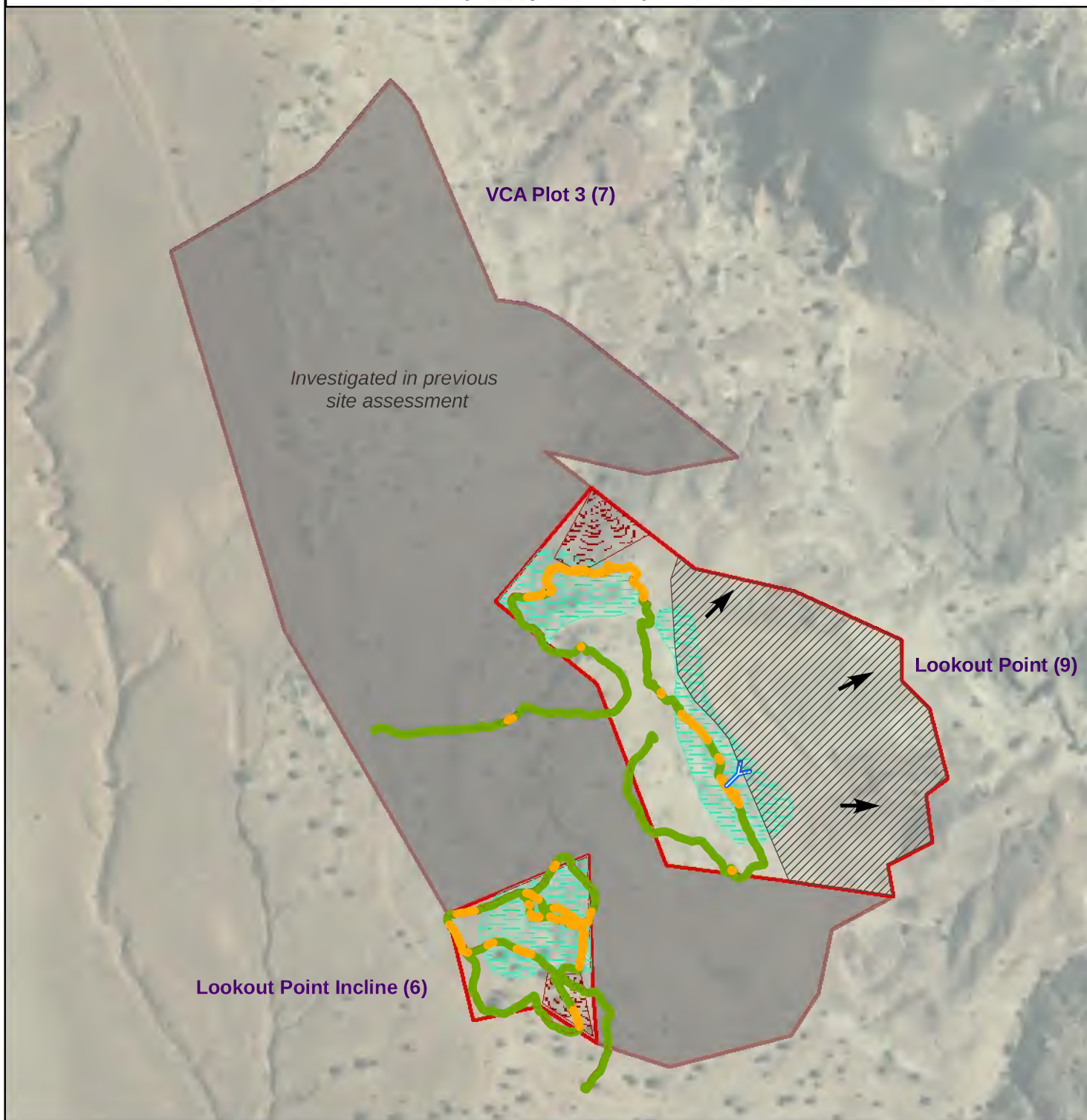
Average background 8,666 cpm



0 160 Feet



**Figure A-11 - Gamma Radiation Measurements, Above Two Times Background  
Lookout Point Incline (6), Lookout Point (9)  
Red Valley Chapter, Navajo Nation**



## Legend

### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 10,732 cpm

- Observed Adit
- Observed Waste Pile
- Observed Reclamation Cap
- General Direction Down-Slope
- Mine Claim Boundaries
- Inaccessible due to steep grades

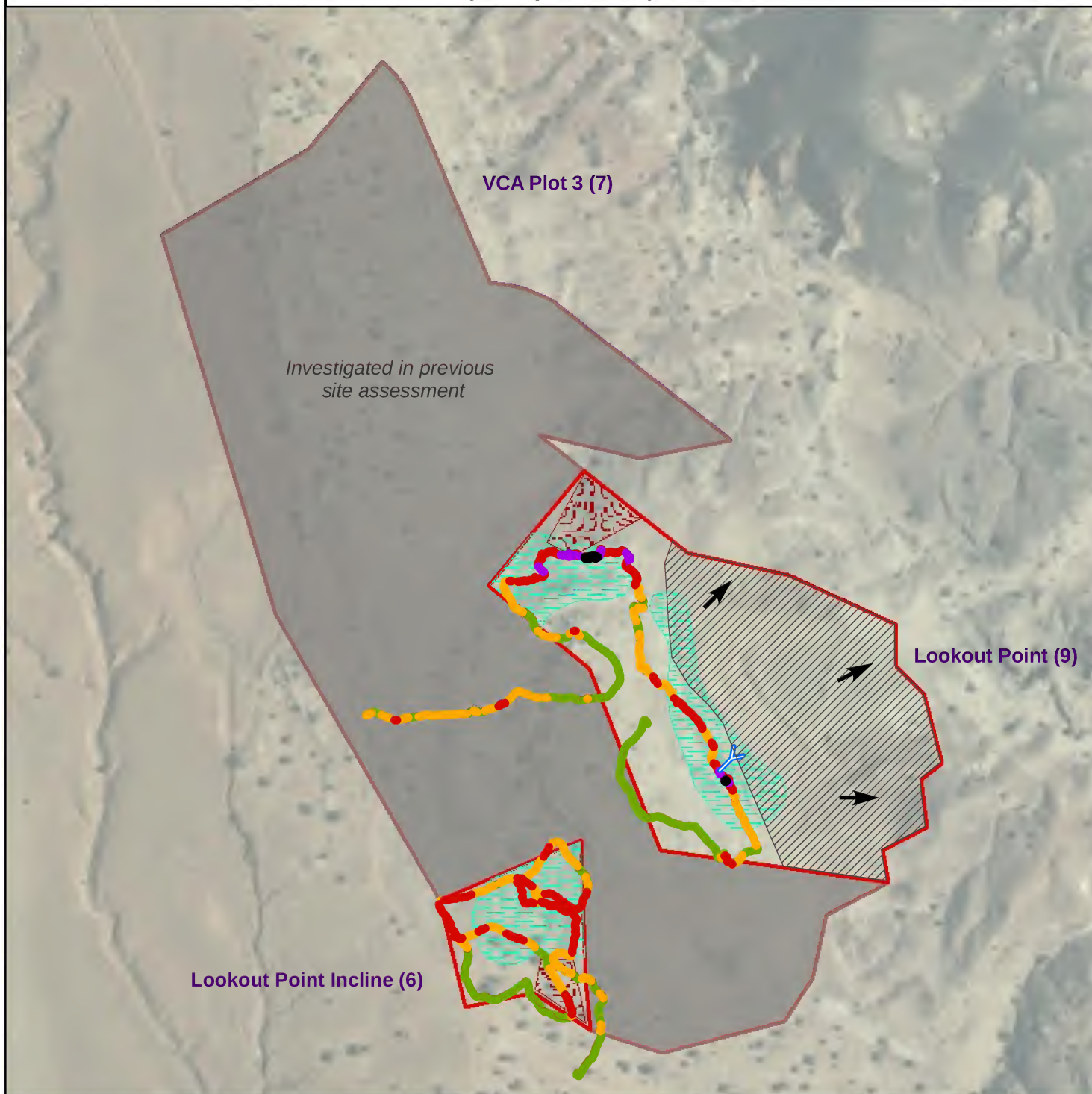


0 450 Feet



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**Figure A-12 - Gamma Radiation Measurements  
Lookout Point Incline (6), Lookout Point (9)  
Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



Observed Adit



Observed Waste Pile



Observed Reclamation Cap



General Direction Down-Slope



Mine Claim Boundaries



Inaccessible due to steep grades

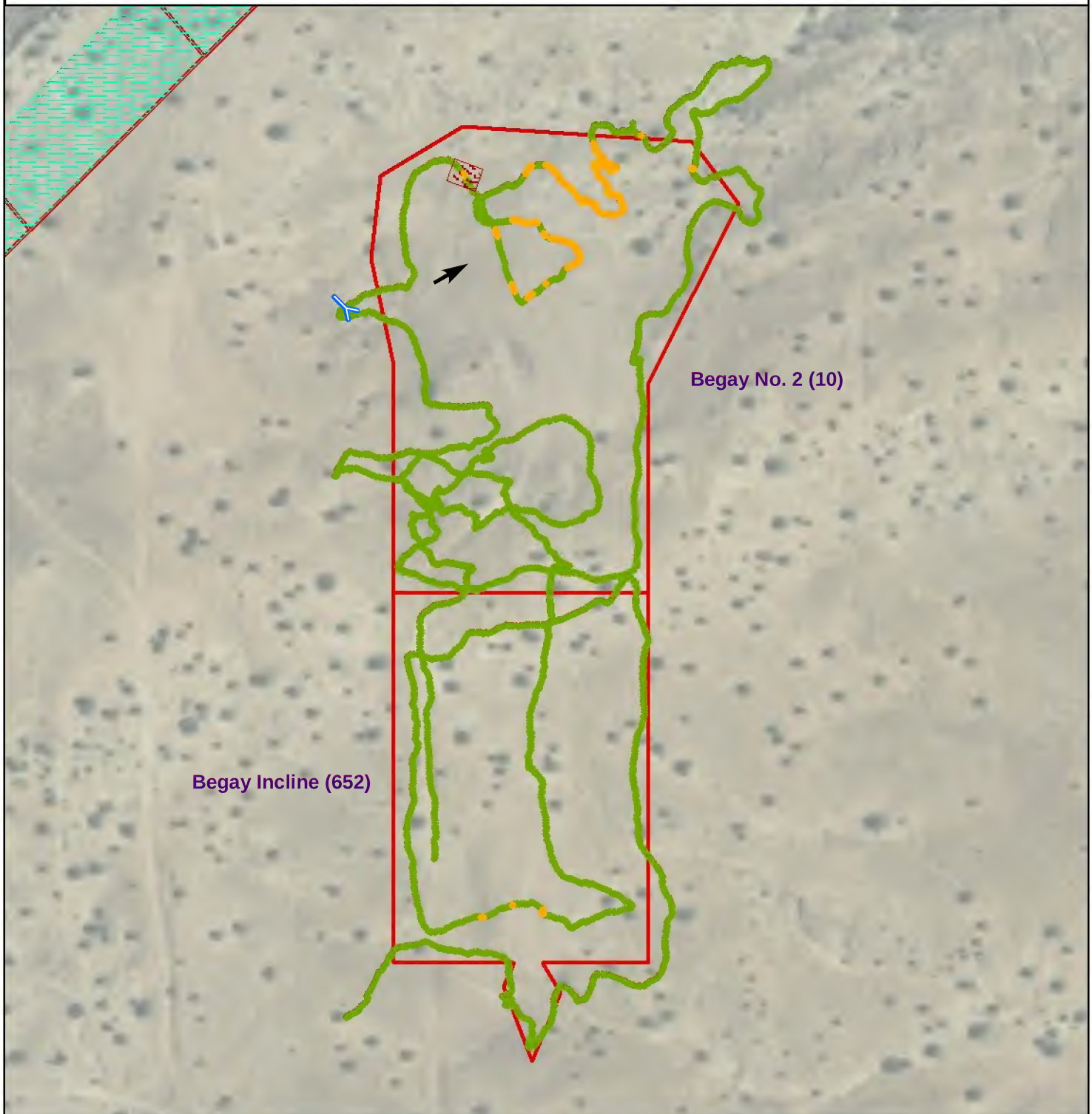
Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)  
Average background 10,732 cpm



0 460 Feet



**Figure A-13 - Gamma Radiation Measurements, Above Two Times Background  
Begay No. 2 (10) and Begay Incline (652)  
Red Valley Chapter, Navajo Nation**







## Legend

### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 9,783 cpm

-  Observed Adit
-  Observed Waste Pile
-  General Direction Down-Slope
-  Mine Claim Boundaries

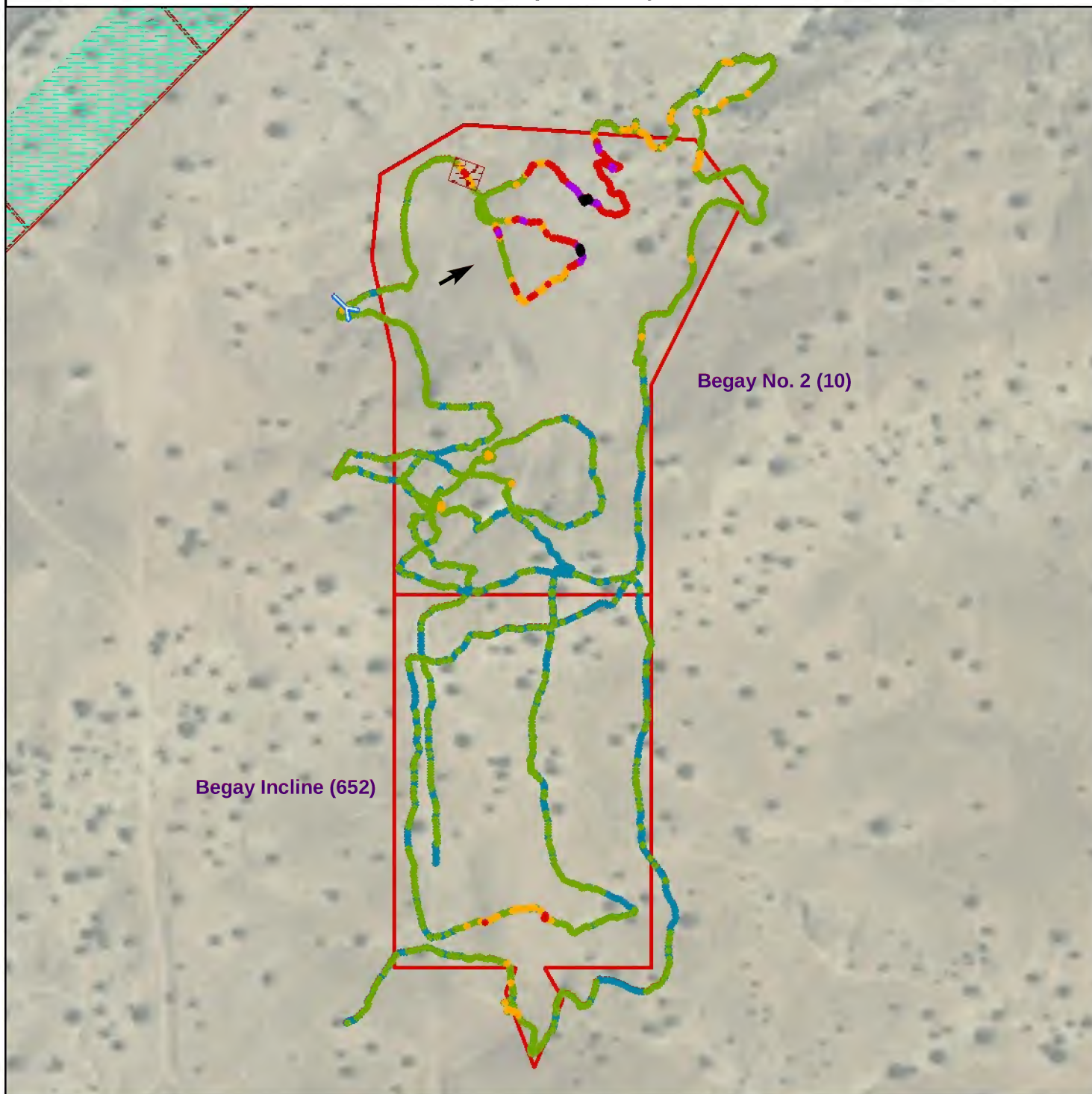


0  360 Feet



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**Figure A-14 - Gamma Radiation Measurements  
Begay No. 2 (10) and Begay Incline (652)  
Red Valley Chapter, Navajo Nation**



### Legend

#### Gamma Radiation Measurements

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



Observed Adit



Observed Waste Pile



General Direction Down-Slope



Mine Claim Boundaries

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background 9,783 cpm



0 320 Feet



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**Figure A-15 - Gamma Radiation Measurements, Above Two Times Background  
Williams Point (12)  
Red Valley Chapter, Navajo Nation**



### Legend

#### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 9,256 cpm

➔ General Direction Down-Slope

▭ Mine Claim Boundaries

▨ Inaccessible due to steep grades

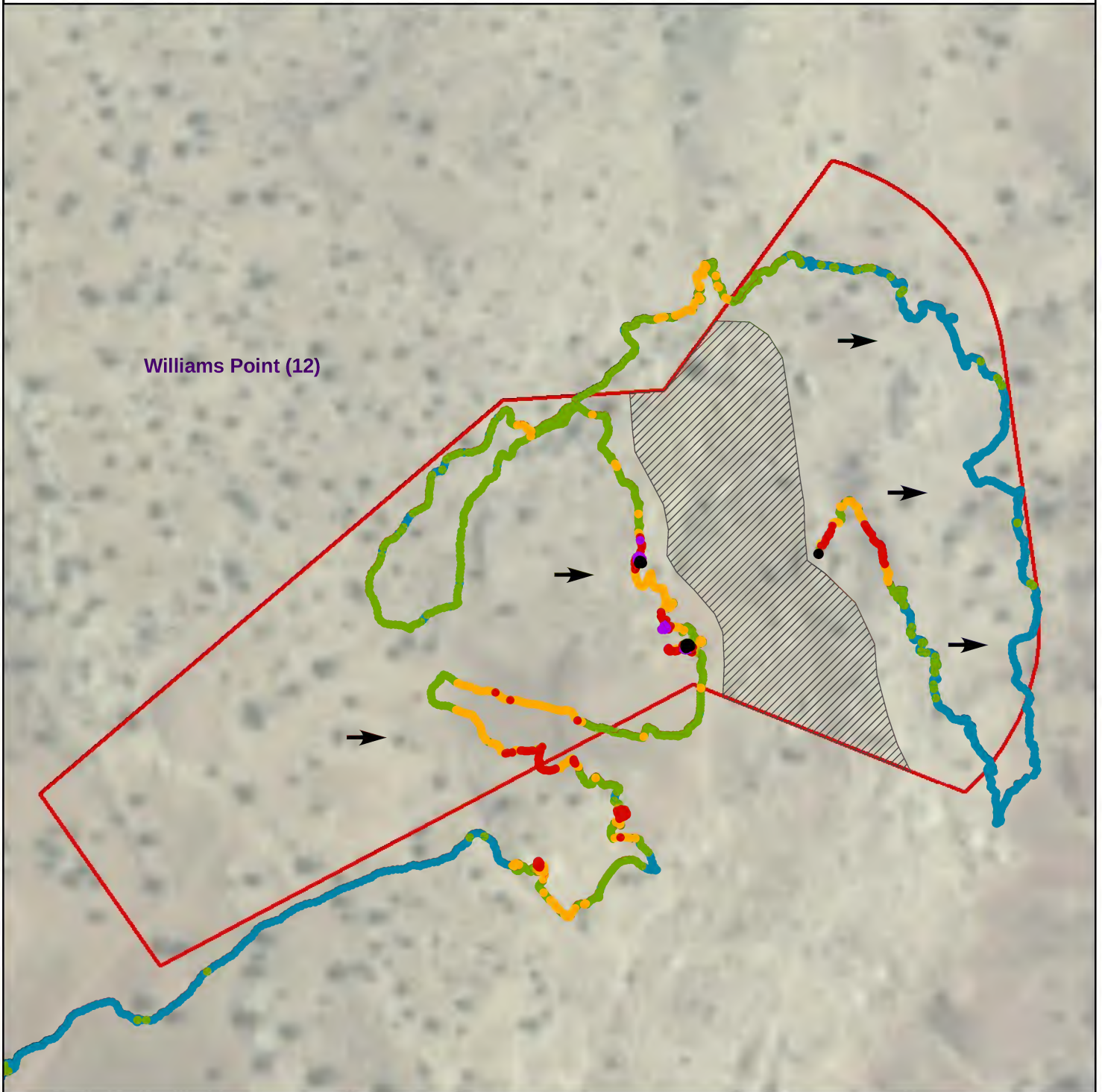


0 220 Feet



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**Figure A-16 - Gamma Radiation Measurements**  
**Williams Point (12)**  
**Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000

➔ General Direction Down-Slope

▭ Mine Claim Boundaries

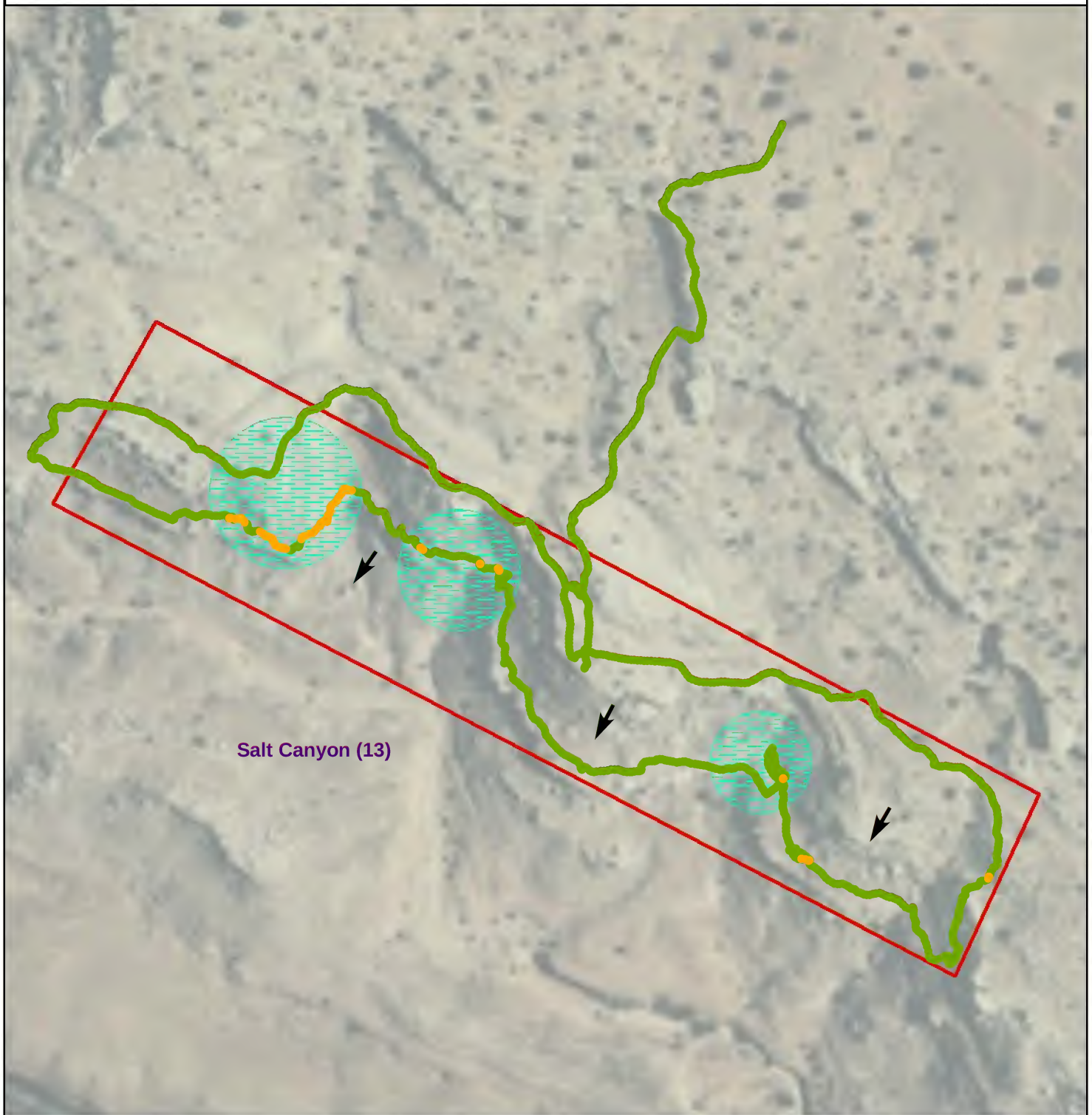
▨ Inaccessible due to steep grades

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background 9,256 cpm



**Figure A-17 - Gamma Radiation Measurements, Above Two Times Background  
Salt Canyon (13)  
Red Valley Chapter, Navajo Nation**






## Legend

### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 8,004 cpm

-  Observed Reclamation Cap
-  General Direction Down-Slope
-  Mine Claim Boundaries



**Figure A-18 - Gamma Radiation Measurements**  
**Salt Canyon (13)**  
**Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



Observed Reclamation Cap



General Direction Down-Slope



Mine Claim Boundaries

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background 8,004



**Figure A-19 - Gamma Radiation Measurements, Above Two Times Background  
Salt Canyon (14)  
Red Valley Chapter, Navajo Nation**



## Legend

### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

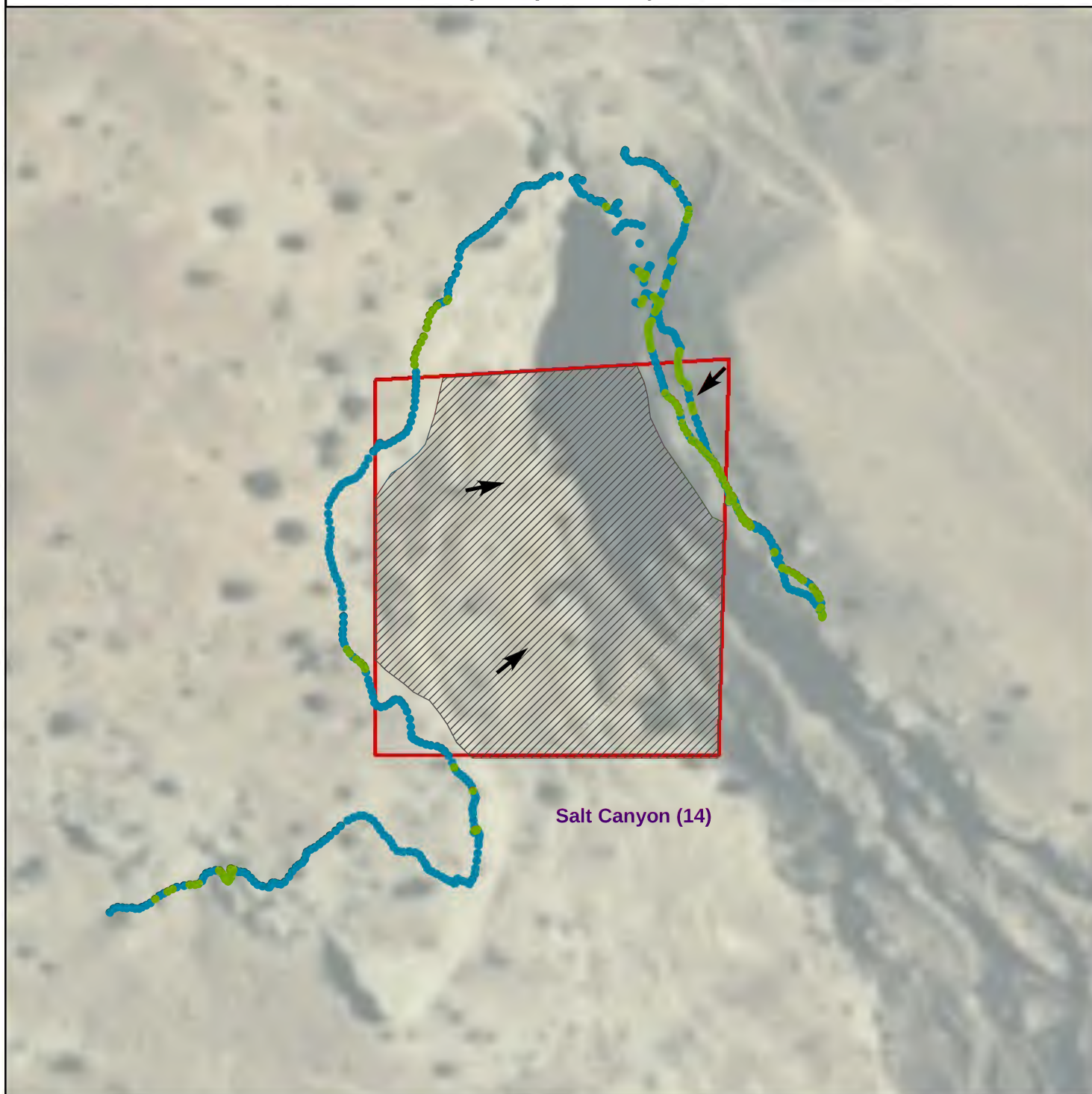
Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 8,593 cpm

- ➔ General Direction Down-Slope
- ▭ Mine Claim Boundaries
- ▨ Inaccessible due to steep grades



**Figure A-20 - Gamma Radiation Measurements**  
**Salt Canyon (14)**  
**Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000

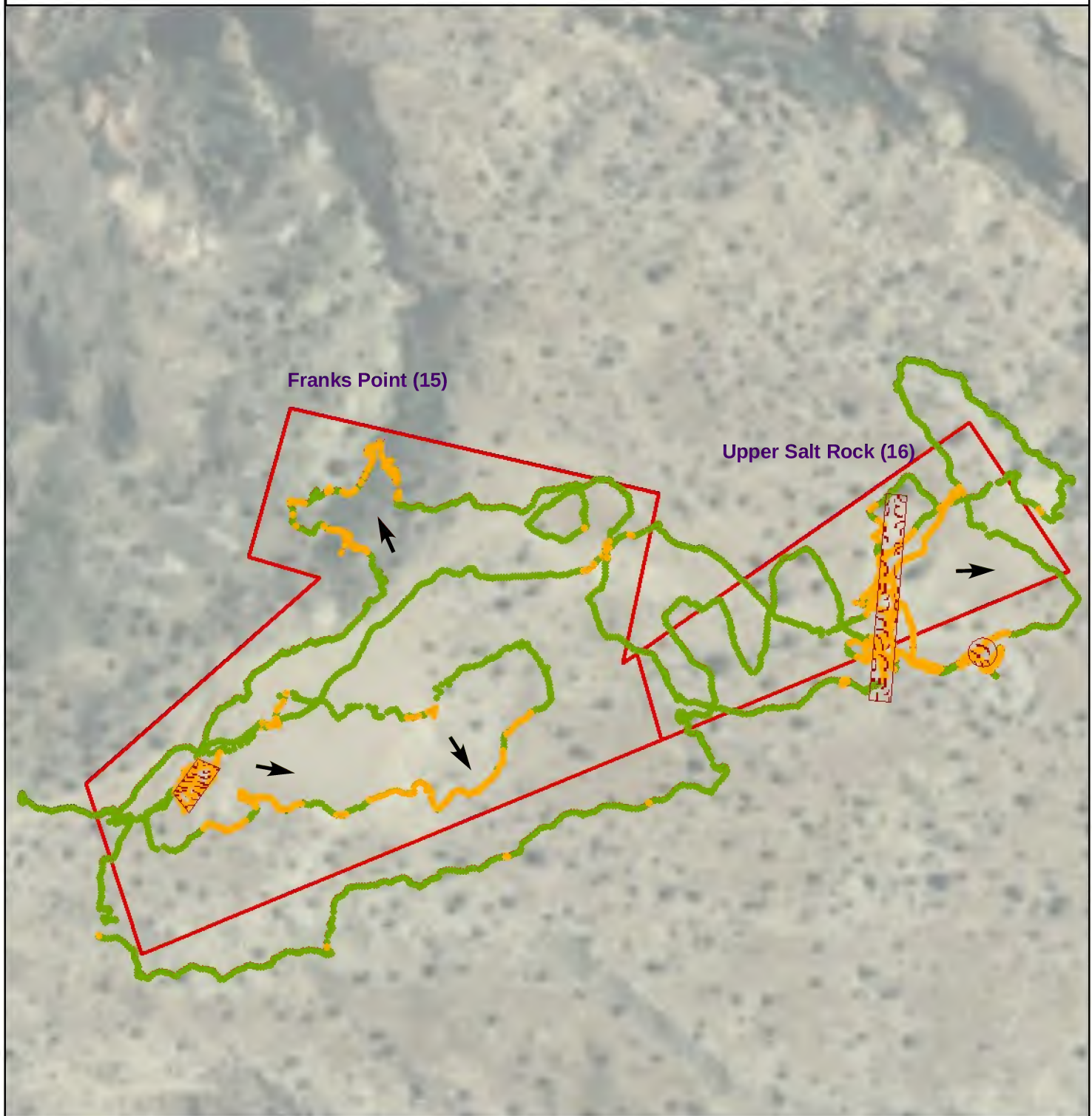
- ➔ General Direction Down-Slope
- ▭ Mine Claim Boundaries
- ▨ Inaccessible due to steep grades

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background 8,593 cpm



**Figure A-21 - Gamma Radiation Measurements, Above Two Times Background  
Franks Point (15) and Upper Salt Rock (16)  
Red Valley Chapter, Navajo Nation**



### Legend

#### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 7,905 cpm



Observed Waste Pile



General Direction Down-Slope

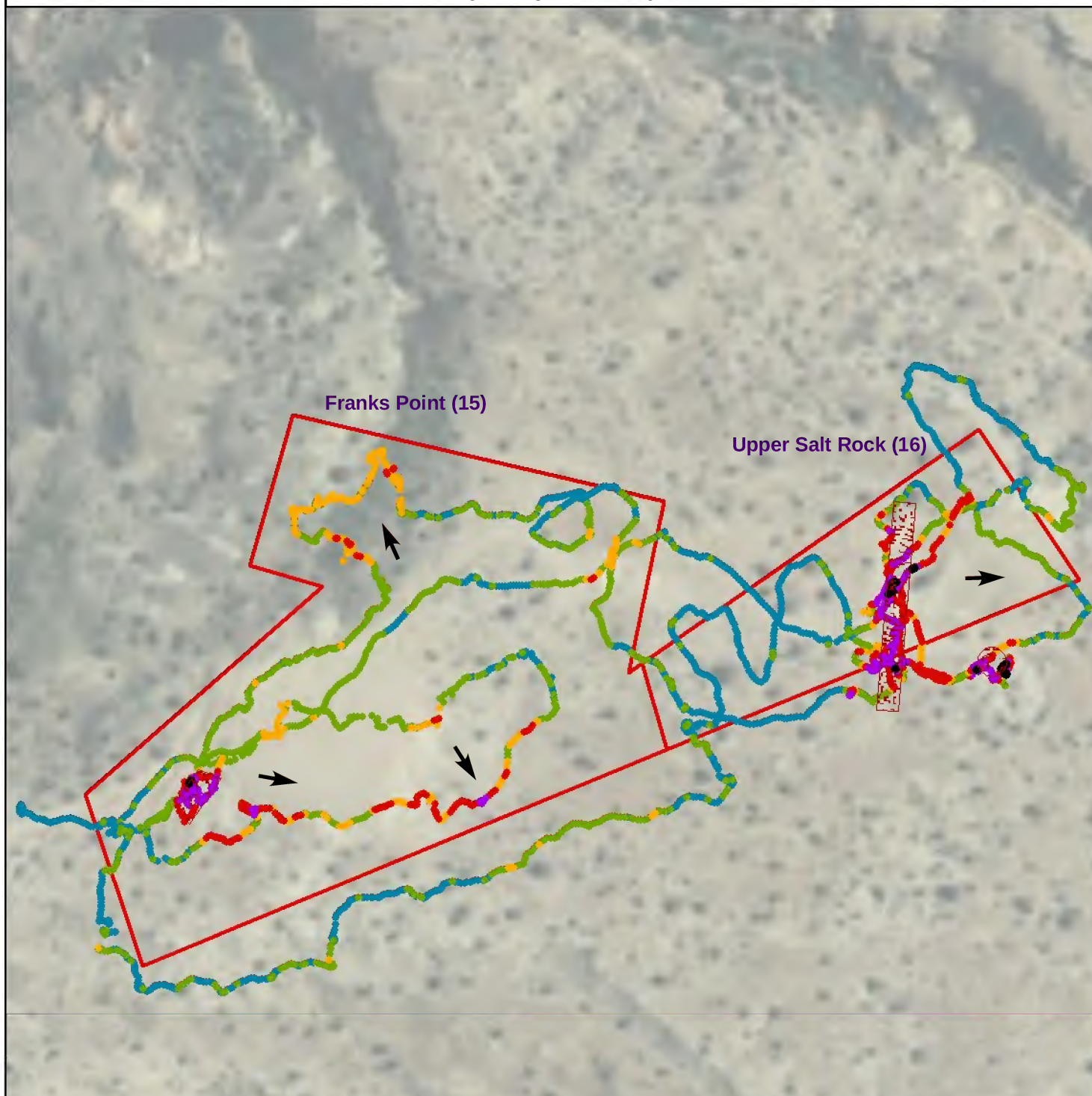


Mine Claim Boundaries



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**Figure A-22 - Gamma Radiation Measurements  
Franks Point (15) and Upper Salt Rock (16)  
Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



**Observed Waste Pile**



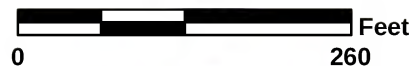
**General Direction Down-Slope**



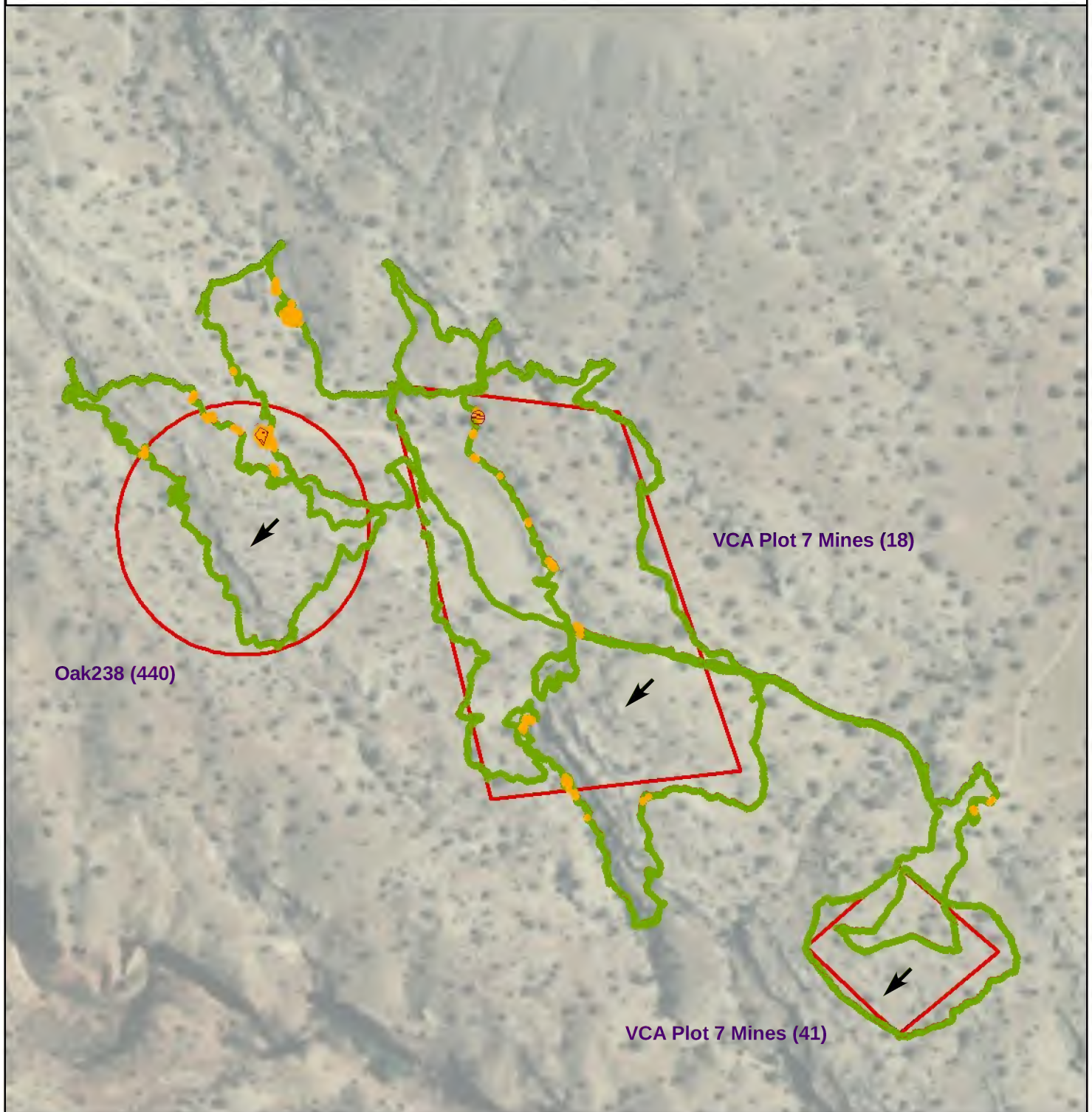
**Mine Claim Boundaries**

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background 7,905 cpm



**Figure A-23 - Gamma Radiation Measurements, Above Two Times Background  
VCA Plot 7 Mines (18, 41) and Oak238 (440)  
Red Valley Chapter, Navajo Nation**



## Legend

### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 9,225 cpm



Observed Waste Pile



General Direction Down-Slope



Mine Claim Boundaries

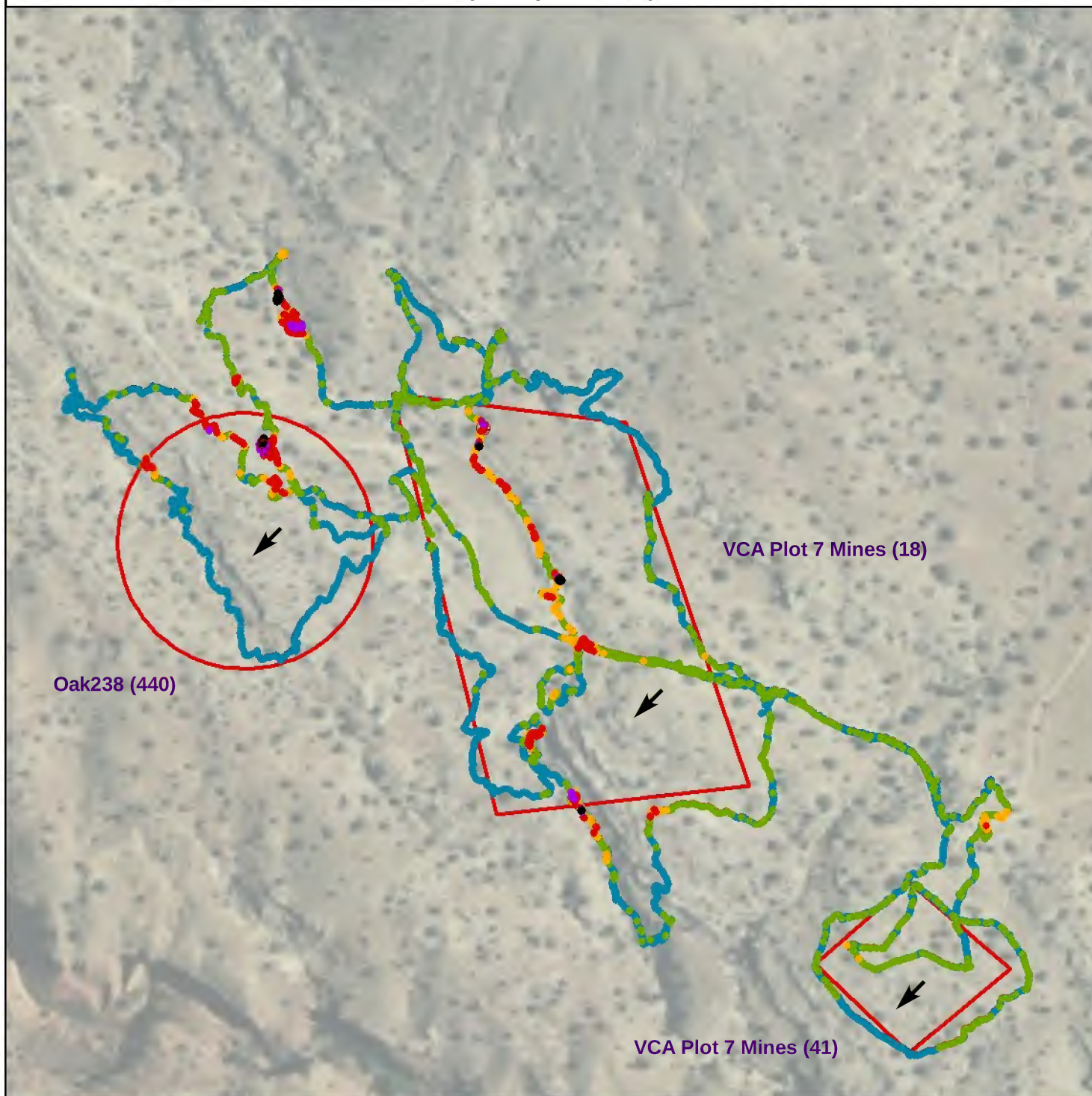


0 280 Feet



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**Figure A-24 - Gamma Radiation Measurements**  
**VCA Plot 7 Mines (18, 41) and Oak238 (440)**  
**Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



**Observed Waste Pile**



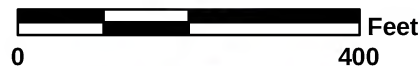
**General Direction Down-Slope**



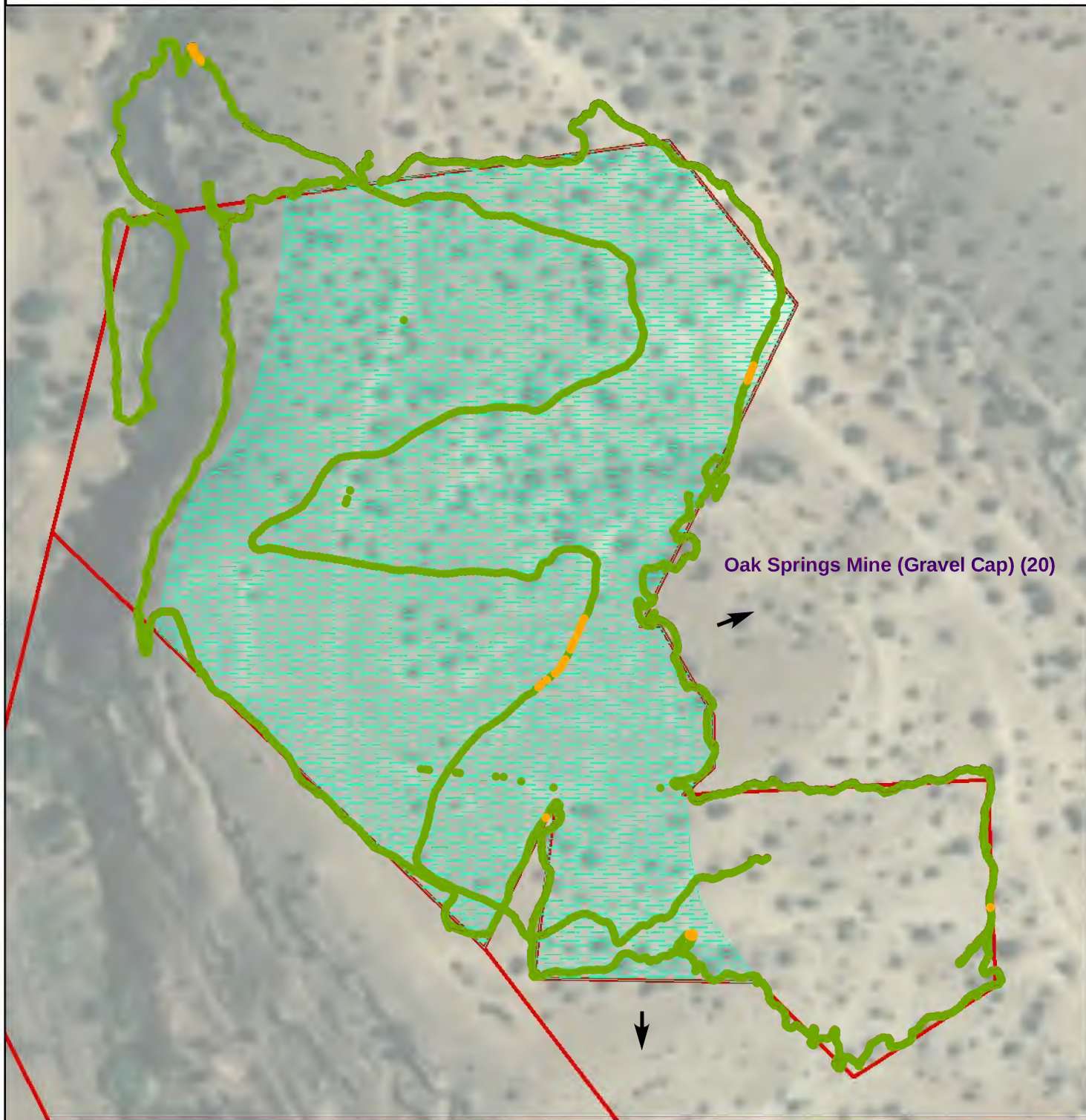
**Mine Claim Boundaries**

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background 9,225 cpm



**Figure A-25 - Gamma Radiation Measurements, Above Two Times Background  
Oak Springs Mine (Gravel Cap) (20)  
Red Valley Chapter, Navajo Nation**






### Legend

#### Gamma Radiation Measurements


- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 8,089 cpm

-  Observed Reclamation Cap
-  General Direction Down-Slope
-  Mine Claim Boundaries



0  300 Feet



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Figure A-26 - Gamma Radiation Measurements  
Oak Springs Mine (Gravel Cap) (20)  
Red Valley Chapter, Navajo Nation



## Legend

### Gamma Radiation Measurements

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



Observed Reclamation Cap



General Direction Down-Slope



Mine Claim Boundaries

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background 8,089 cpm



0 280 Feet



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**Figure A-27 - Gamma Radiation Measurements, Above Two Times Background  
Red Wash (Hosteen S. Begay) (30)  
Red Valley Chapter, Navajo Nation**



## Legend

### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 11,267 cpm

 Observed Reclamation Cap

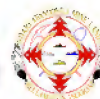
 Observed Waste Pile

 General Direction Down-Slope

 Mine Claim Boundaries

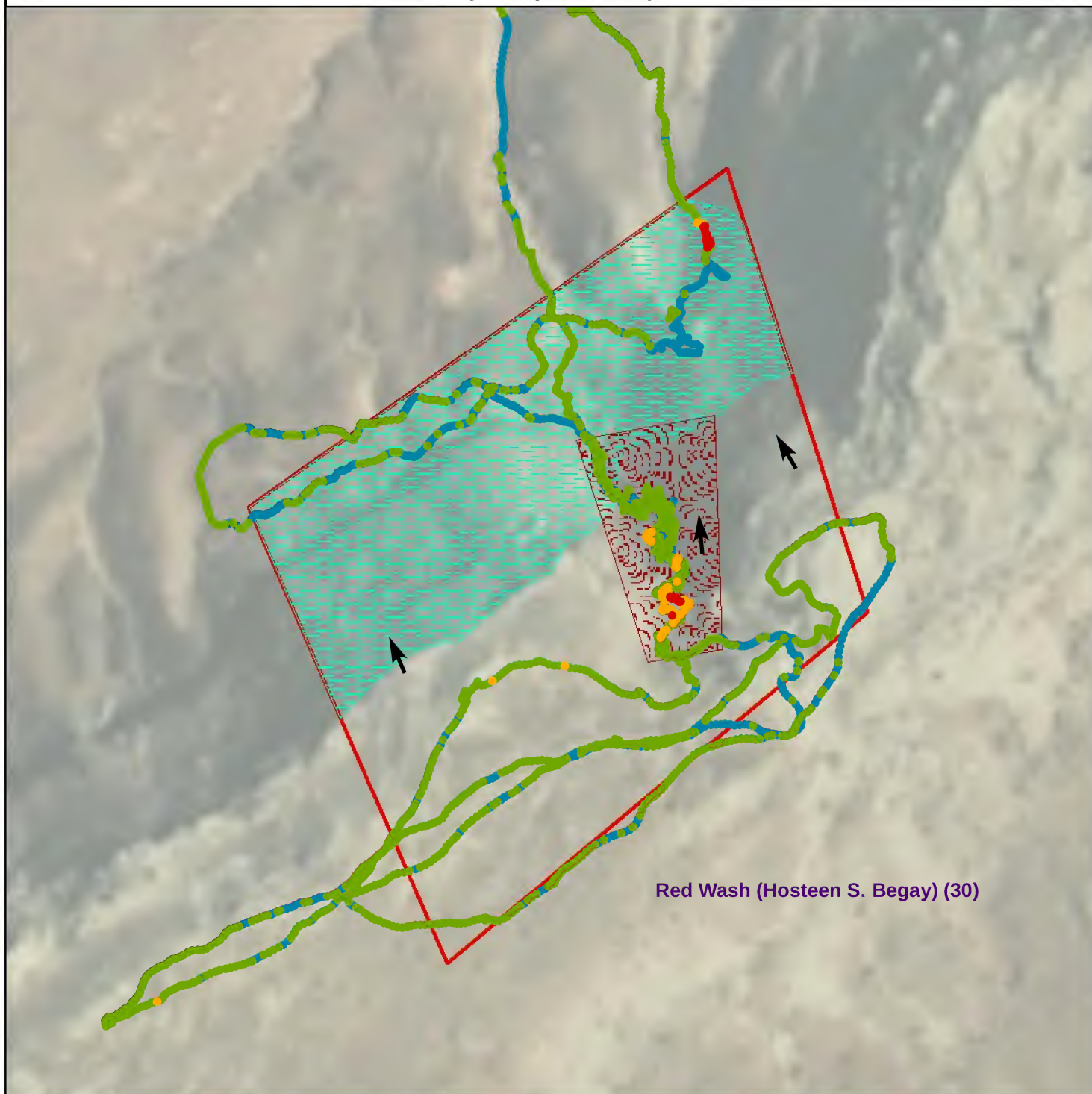


0 180 Feet



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**Figure A-28 - Gamma Radiation Measurements**  
**Red Wash (Hosteen S. Begay) (30)**  
**Red Valley Chapter, Navajo Nation**



## Legend

### Gamma Radiation Measurements

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



Observed Reclamation Cap



Observed Waste Pile



General Direction Down-Slope



Mine Claim Boundaries

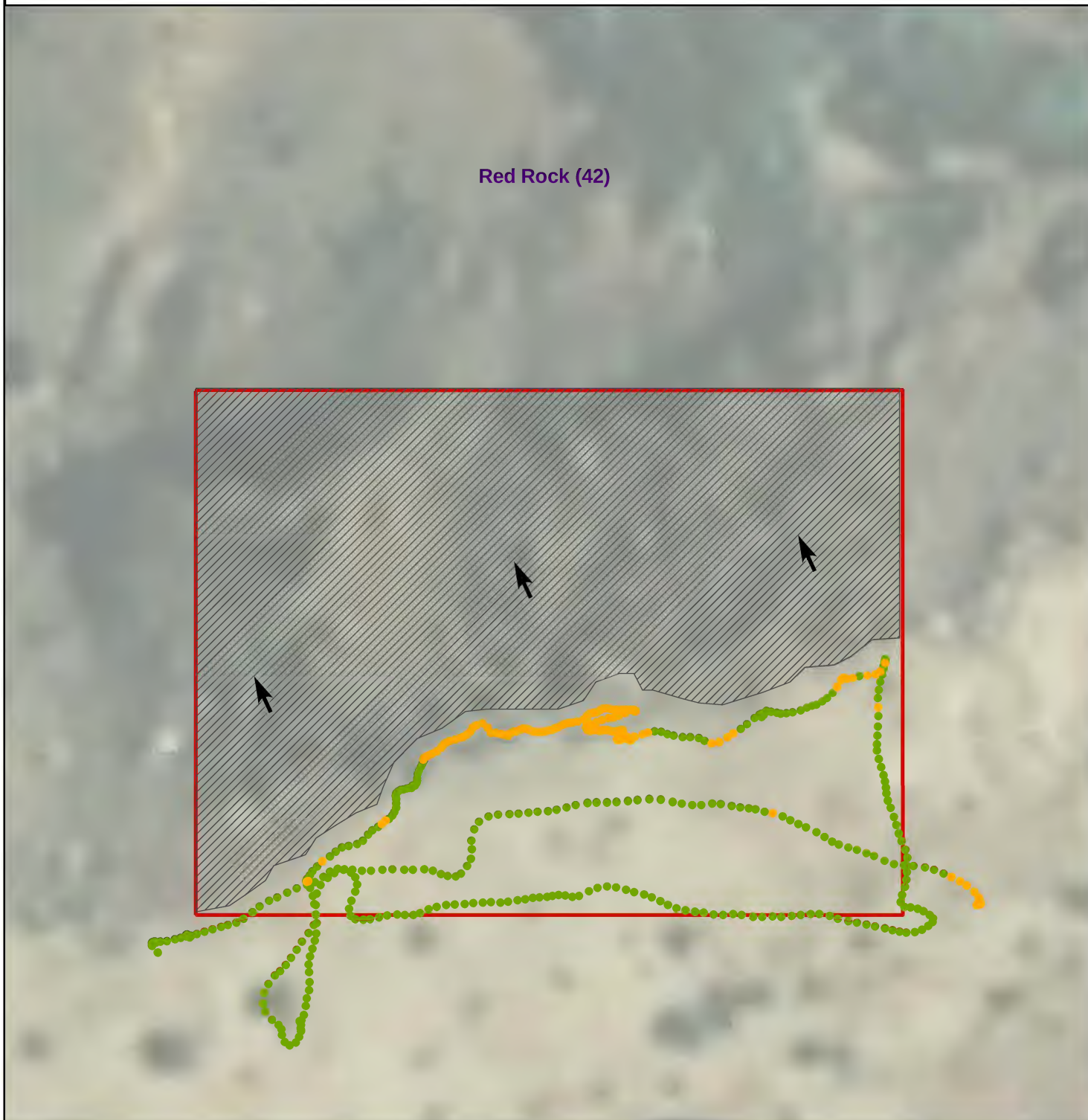
Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background 11,267 cpm



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**Figure A-29 - Gamma Radiation Measurements, Above Two Times Background  
Red Rock (42)  
Red Valley Chapter, Navajo Nation**



## Legend

### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

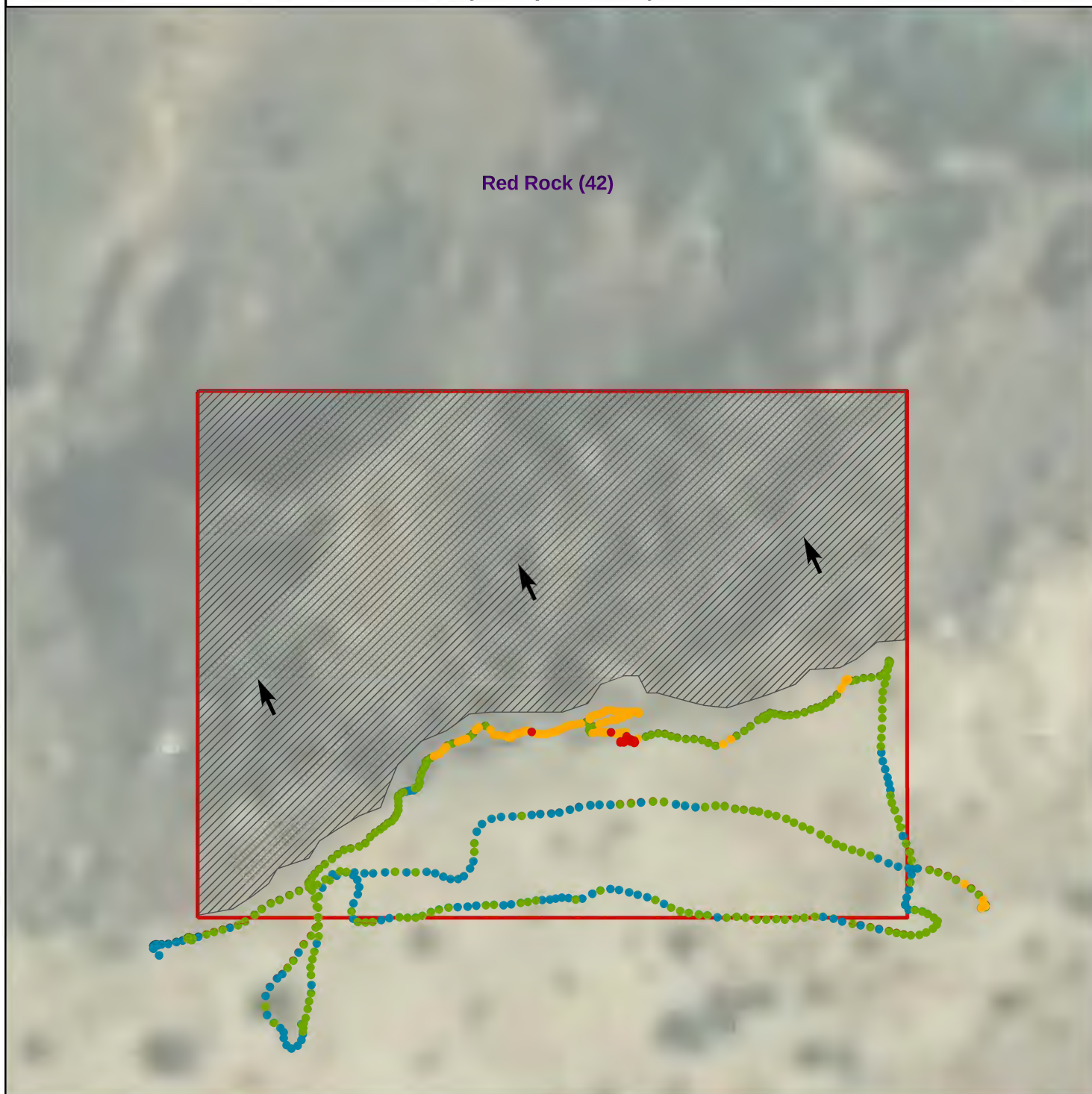
Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 6,455 cpm

- ➔ General Direction Down-Slope
- ▭ Mine Claim Boundaries
- ▨ Inaccessible due to steep grades



Figure A-30 - Gamma Radiation Measurements  
Red Rock (42)  
Red Valley Chapter, Navajo Nation



## Legend

### Gamma Radiation Measurements

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000

➔ General Direction Down-Slope

▭ Mine Claim Boundaries

▨ Inaccessible due to steep grades

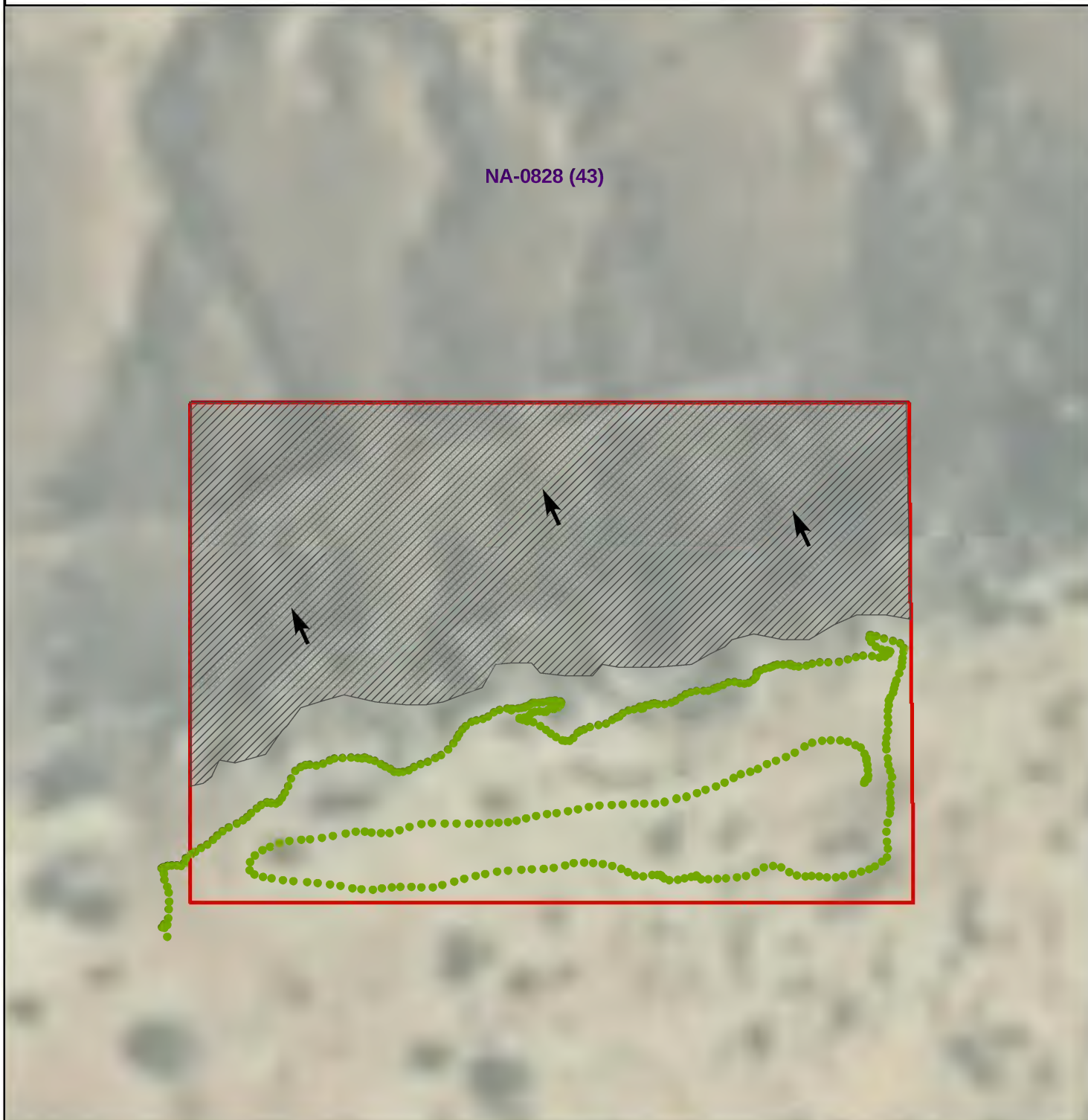
Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background 6,455 cpm



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**Figure A-31 - Gamma Radiation Measurements, Above Two Times Background  
NA-0828 (43)  
Red Valley Chapter, Navajo Nation**



## Legend

### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

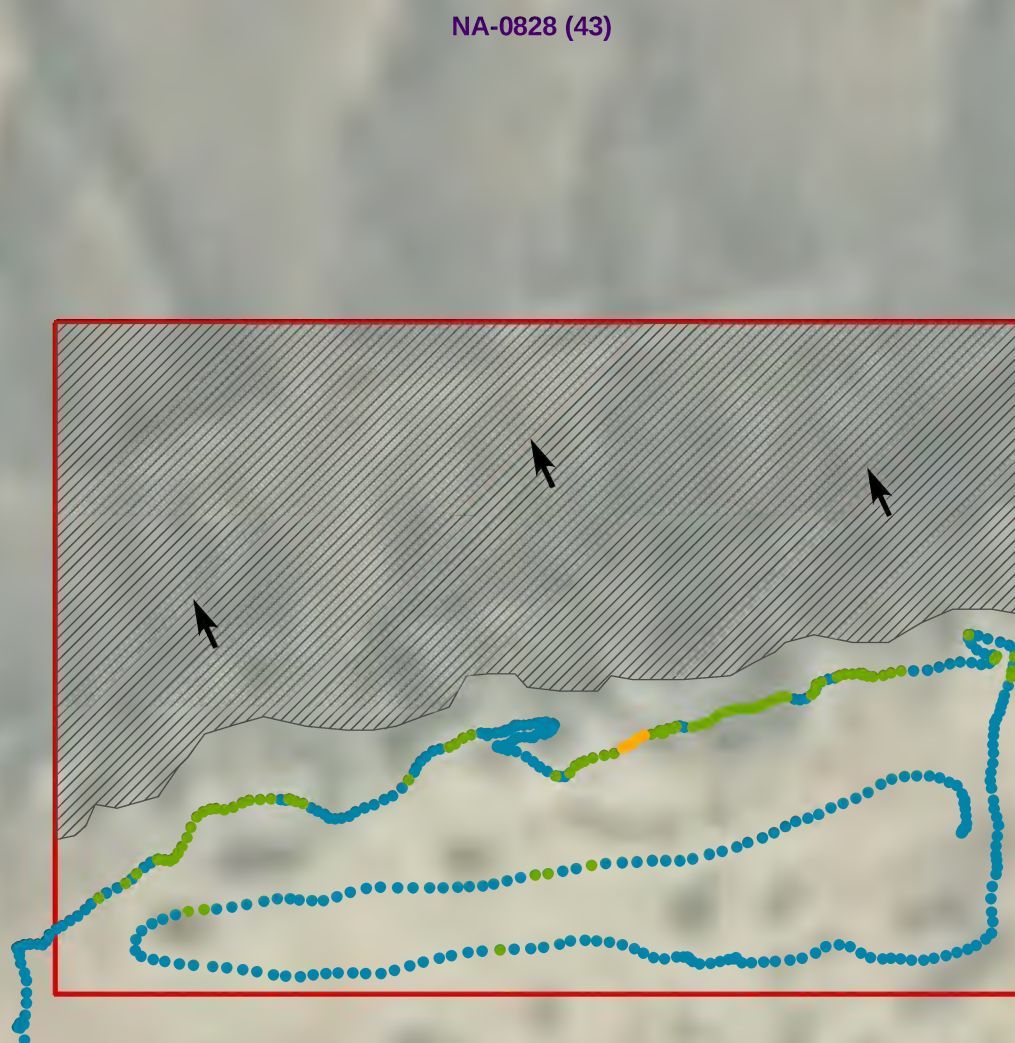
Average background = 10,512 cpm

- ➔ General Direction Down-Slope
- ▭ Mine Claim Boundaries
- ▨ Inaccessible due to steep grades



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Figure A-32 - Gamma Radiation Measurements  
NA-0828 (43)  
Red Valley Chapter, Navajo Nation



## Legend

### Gamma Radiation Measurements

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000

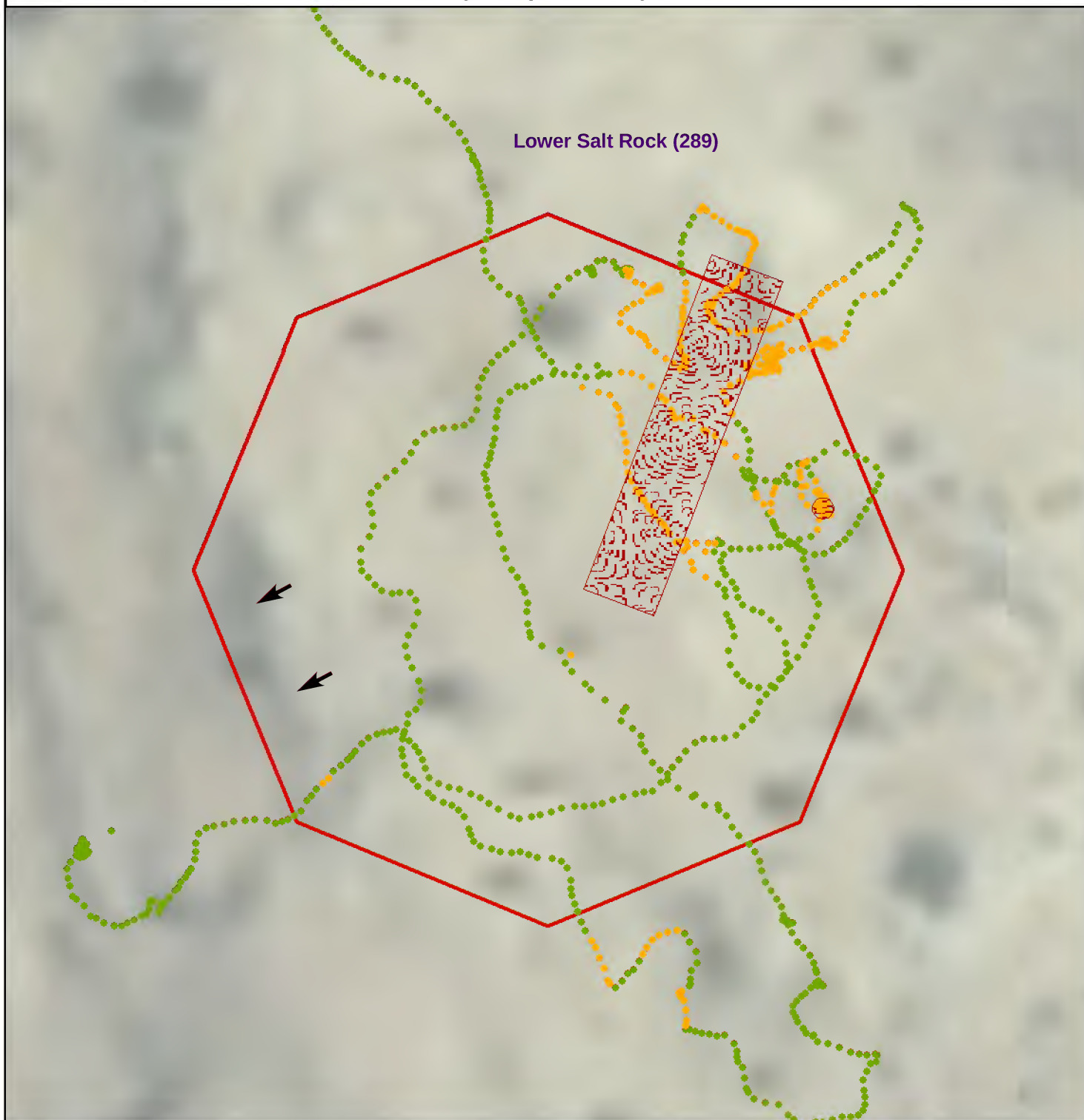
- ➔ General Direction Down-Slope
- ▭ Mine Claim Boundaries
- ▨ Inaccessible due to steep grades

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background 10,512 cpm



**Figure A-33 - Gamma Radiation Measurements, Above Two Times Background  
Lower Salt Rock (289)  
Red Valley Chapter, Navajo Nation**



### Legend

#### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 9,621 cpm



Observed Waste Pile



General Direction Down-Slope



Mine Claim Boundaries

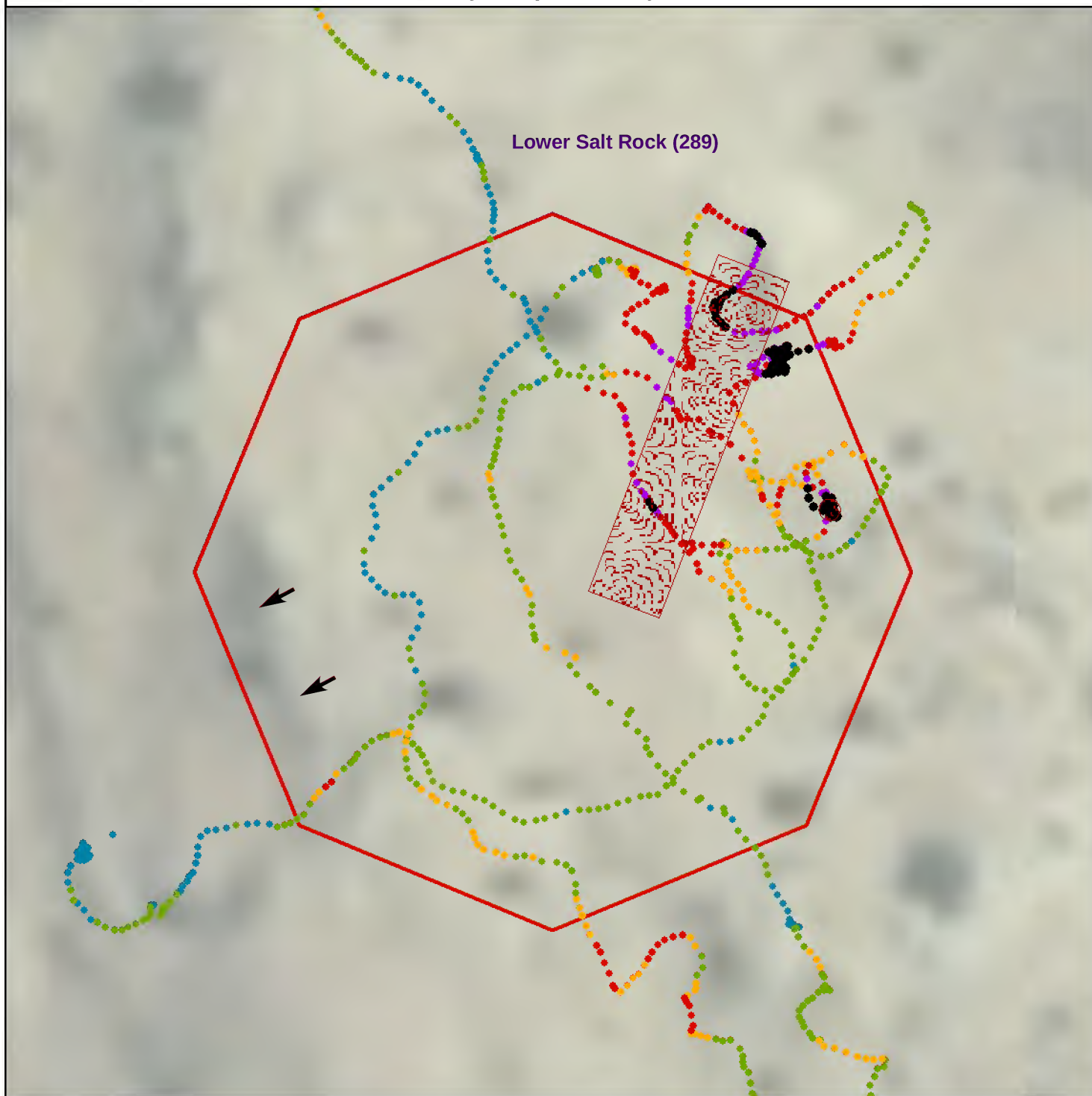


0 Feet  
60



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**Figure A-34 - Gamma Radiation Measurements**  
**Lower Salt Rock (289)**  
**Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



**Observed Waste Pile**



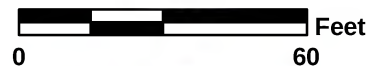
**General Direction Down-Slope**



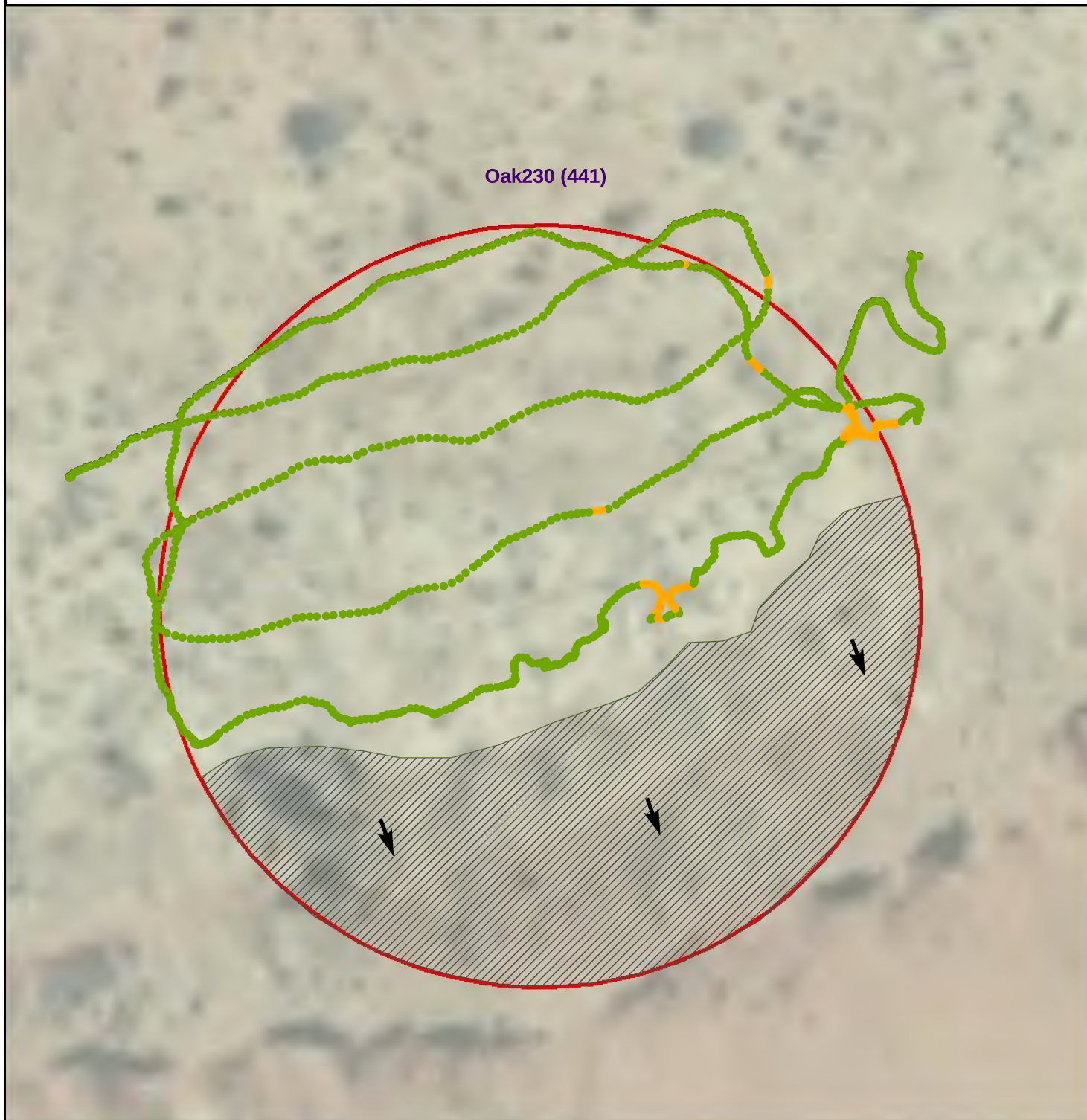
**Mine Claim Boundaries**

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background 9,621 cpm



**Figure A-35 - Gamma Radiation Measurements, Above Two Times Background  
Oak230 (441)  
Red Valley Chapter, Navajo Nation**



### Legend

#### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 8,386 cpm



Observed Waste Pile



General Direction Down-Slope



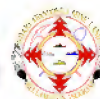
Mine Claim Boundaries



Inaccessible due to steep grades

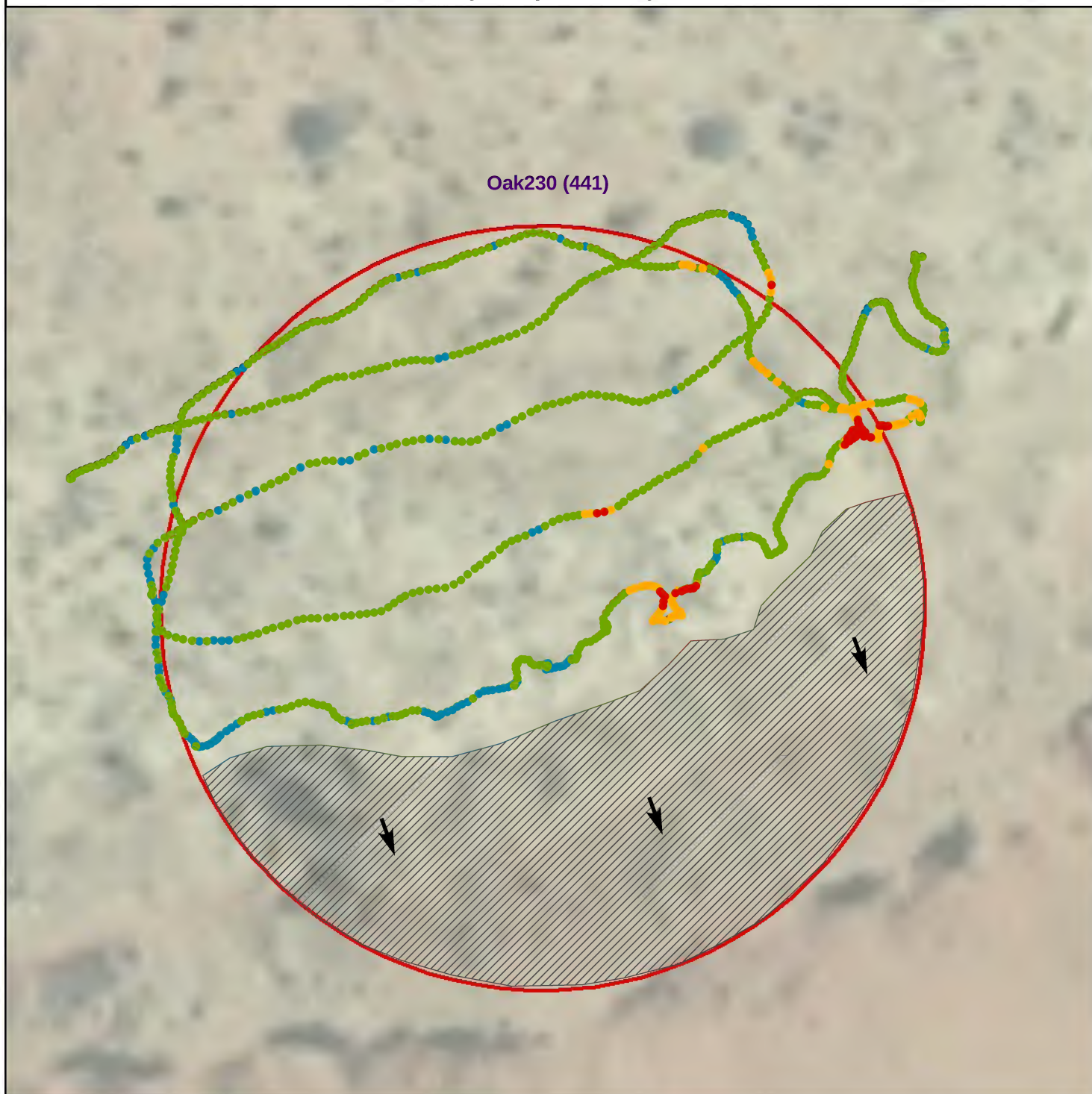


0 140 Feet



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**Figure A-36 - Gamma Radiation Measurements**  
**Oak230 (441)**  
**Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



**Observed Waste Pile**



**General Direction Down-Slope**



**Mine Claim Boundaries**



**Inaccessible due to steep grades**

**Gamma survey conducted 06/2010**  
**Measured as counts per minute (cpm)**

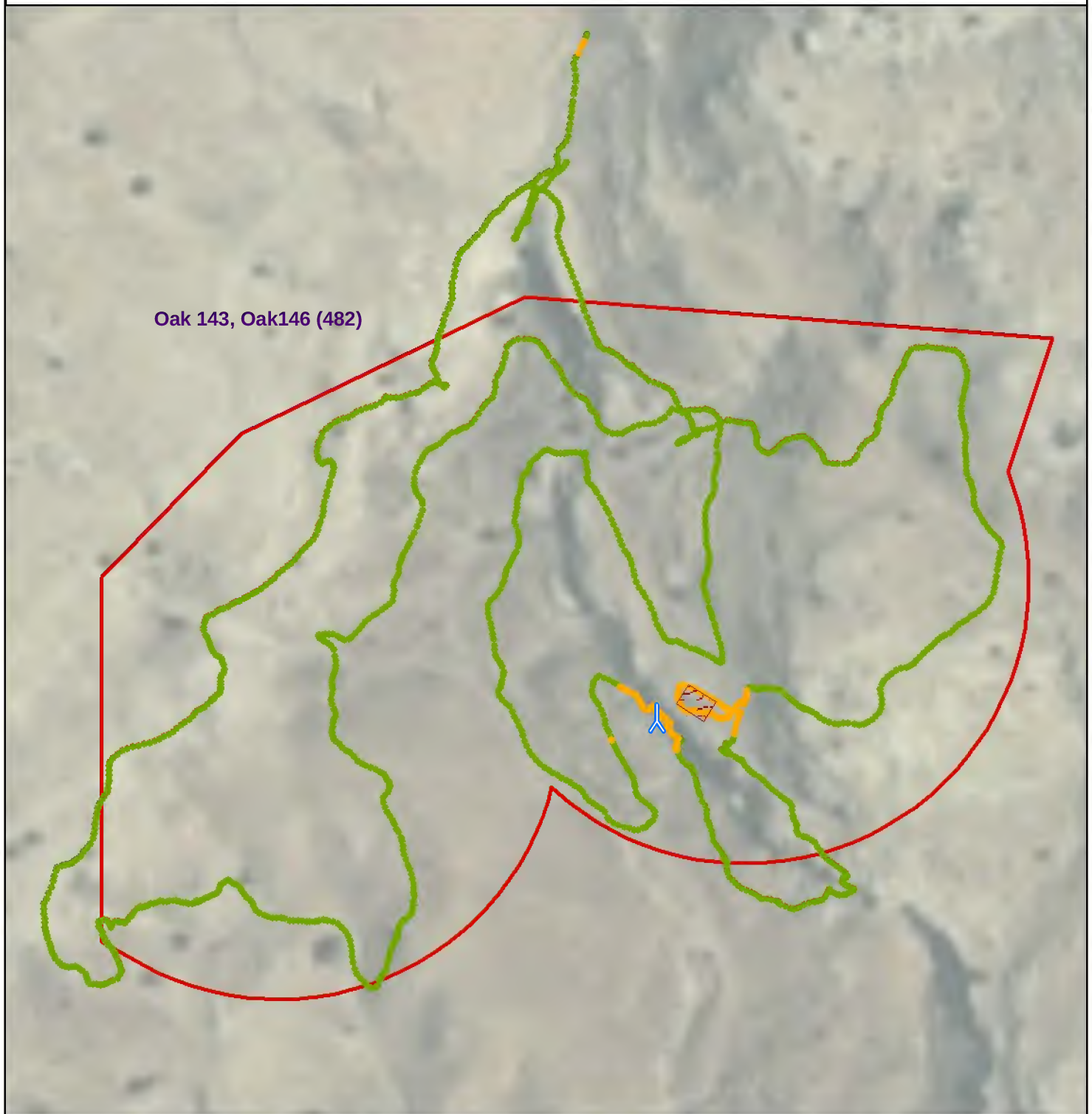
**Average background 8,386 cpm**



0 140 Feet



**Figure A-37 - Gamma Radiation Measurements, Above Two Times Background**  
**Oak 143, Oak146 (482)**  
**Red Valley Chapter, Navajo Nation**



## Legend

### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background = 12,932 cpm



Observed Waste Pile



General Direction Down-Slope



Mine Claim Boundaries

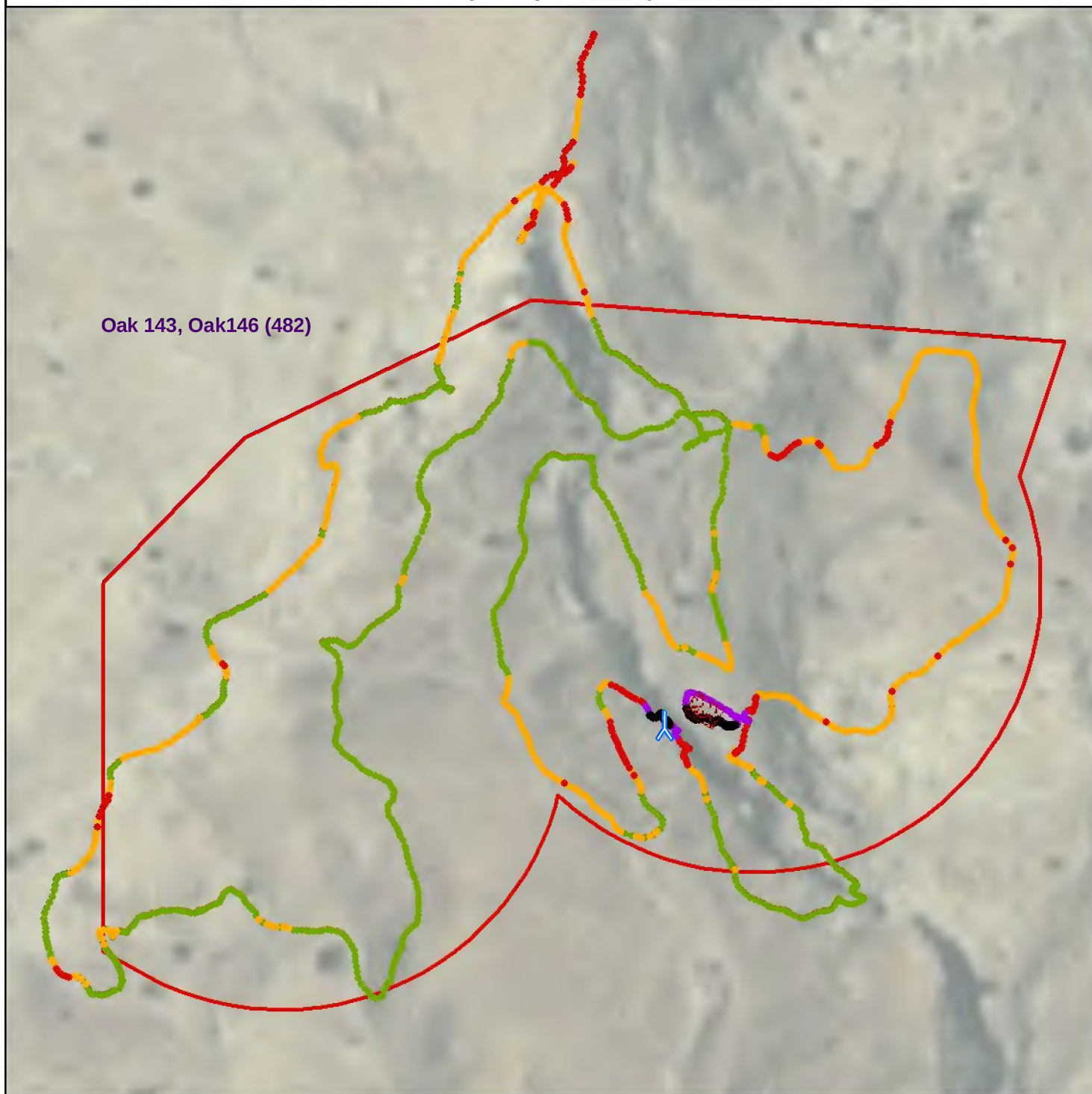


0 180 Feet



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**Figure A-38 - Gamma Radiation Measurements**  
**Oak 143, Oak146 (482)**  
**Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000

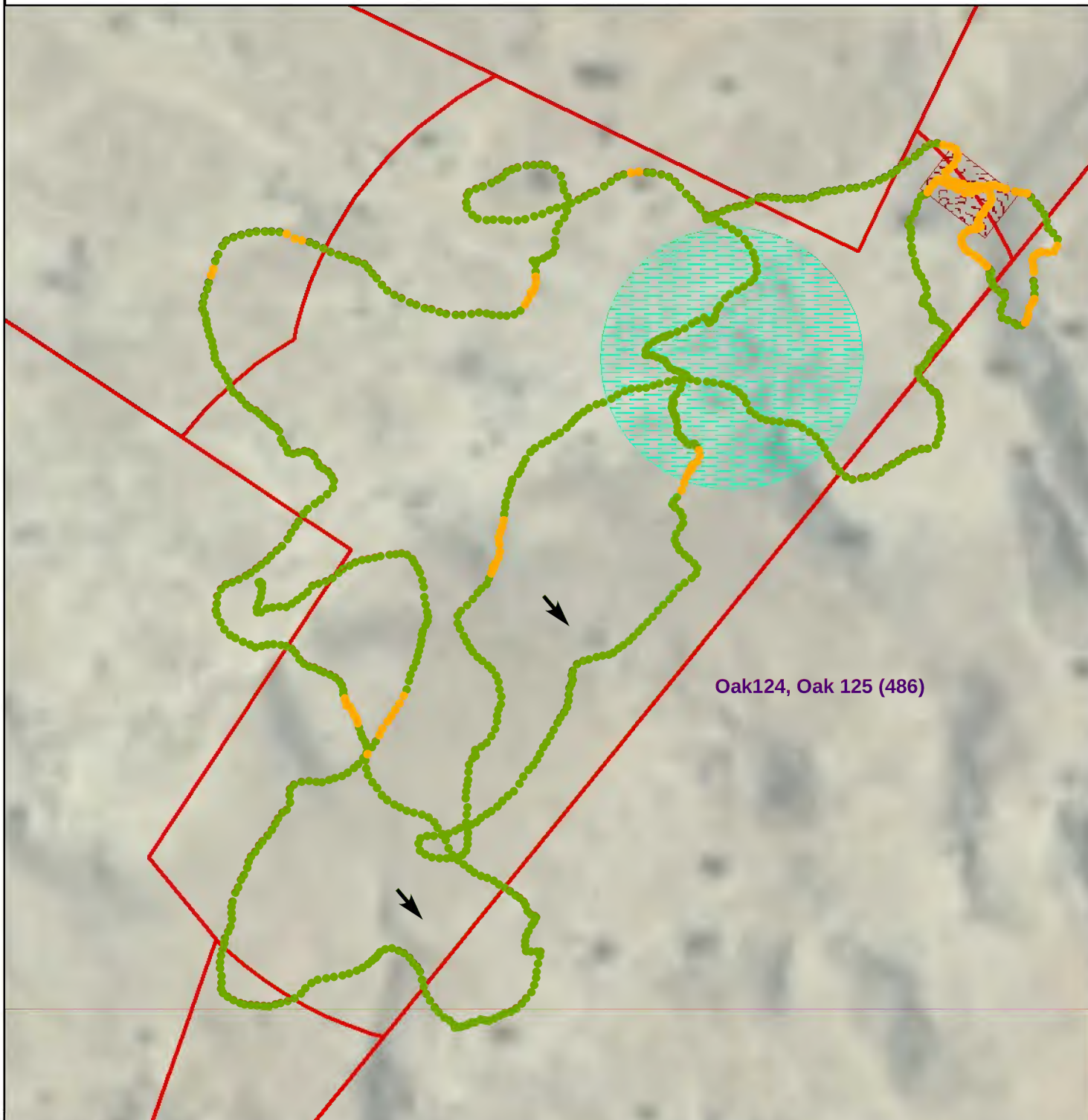
- Observed Adit
- Observed Waste Pile
- General Direction Down-Slope
- Mine Claim Boundaries

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background 12,932 cpm



**Figure A-39 - Gamma Radiation Measurements, Above Two Times Background**  
**Oak124, Oak 125 (486)**  
**Red Valley Chapter, Navajo Nation**



### Legend

#### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background = 10,310 cpm



Observed Reclamation Cap



Observed Waste Pile



General Direction Down-Slope

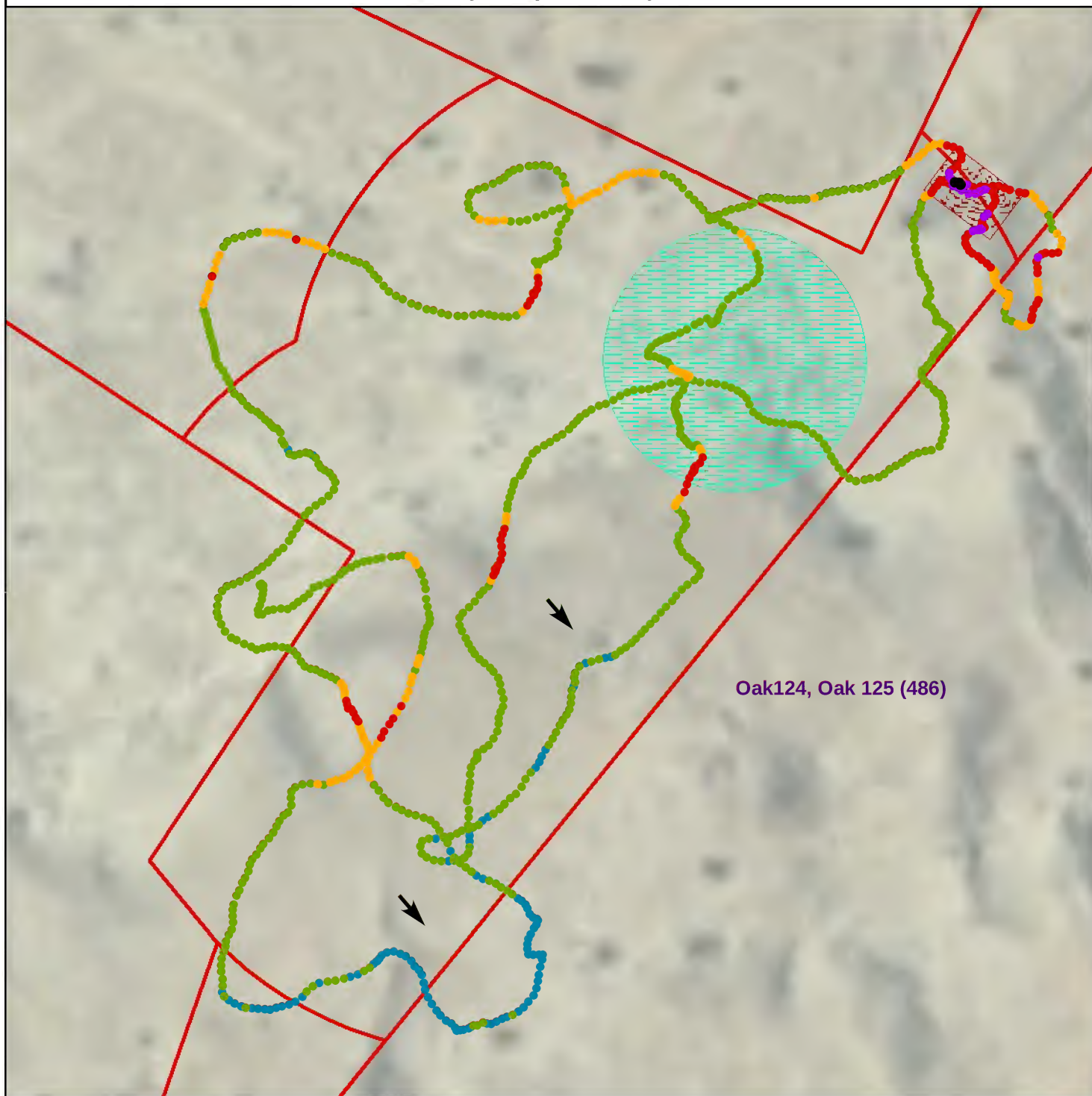


Mine Claim Boundaries



**WESTON**  
 SOLUTIONS

**Figure A-40 - Gamma Radiation Measurements**  
**Oak124, Oak 125 (486)**  
**Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



Observed Reclamation Cap

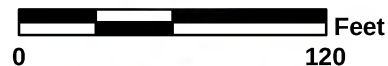
Observed Waste Pile

General Direction Down-Slope

Mine Claim Boundaries

Gamma survey conducted 06/2010  
 Measured as counts per minute (cpm)

Average background 9,459 cpm



**Figure A-41 - Gamma Radiation Measurements, Above Two Times Background  
King Tutt Point (487)  
Red Valley Chapter, Navajo Nation**



### Legend

#### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 9,487 cpm

- Observed Adit
- Observed Waste Pile
- General Direction Down-Slope
- Mine Claim Boundaries

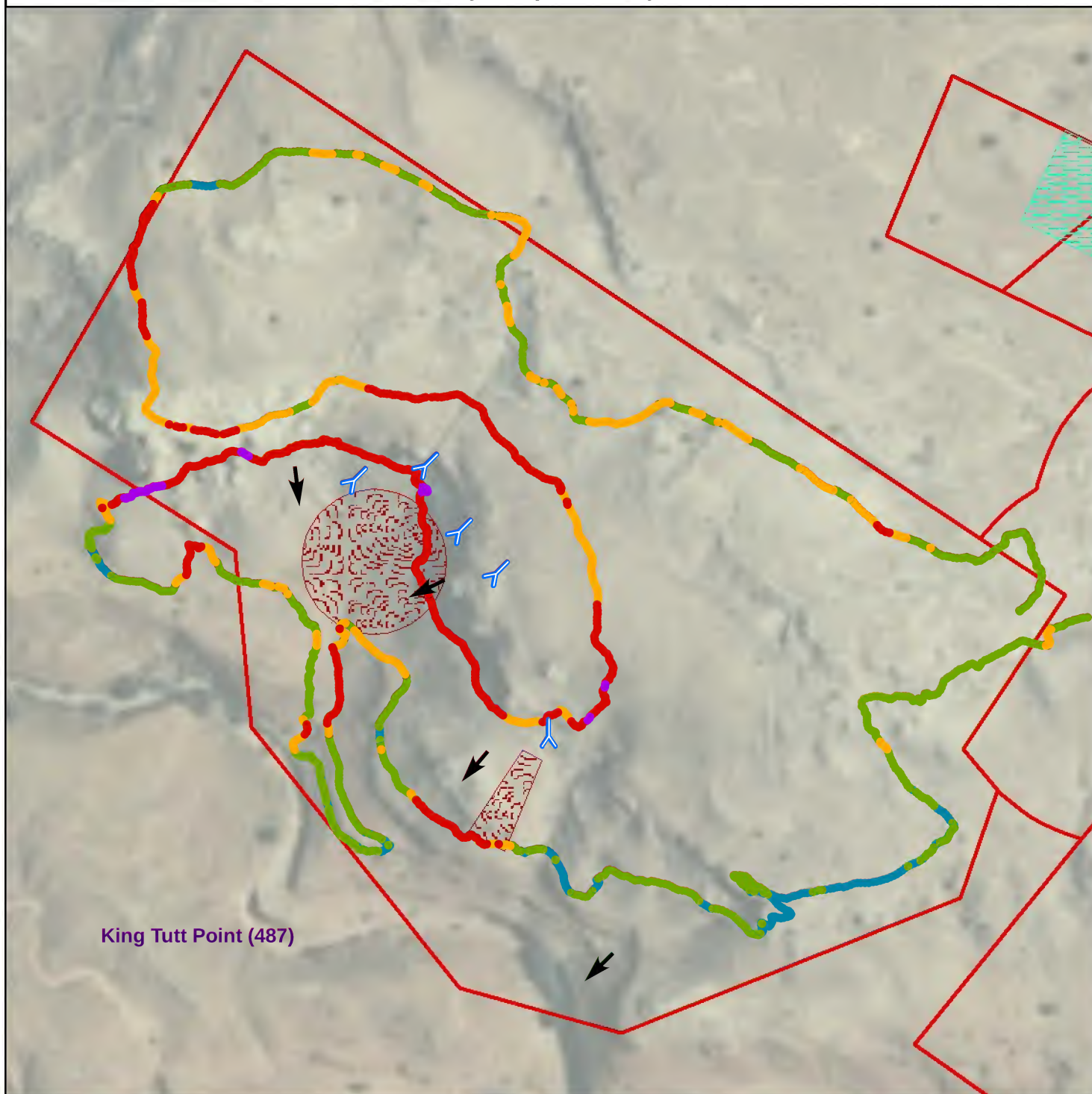


0 260 Feet



**WESTON**  
SOLUTIONS

**Figure A-42 - Gamma Radiation Measurements  
King Tutt Point (487)  
Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000

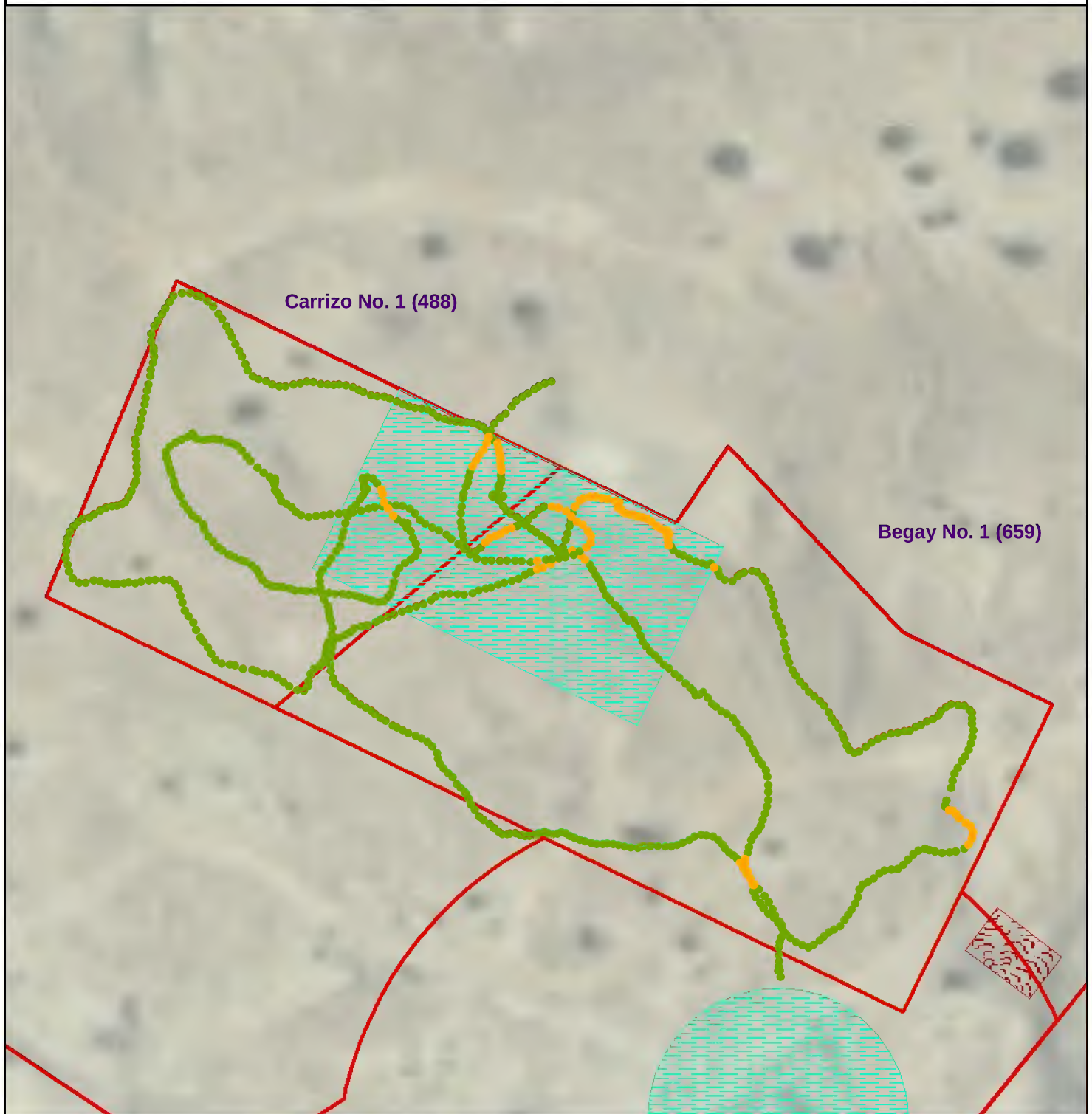
- Observed Adit
- Observed Waste Pile
- General Direction Down-Slope
- Mine Claim Boundaries

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background 9,487 cpm



**Figure A-43 - Gamma Radiation Measurements, Above Two Times Background  
Carrizo No. 1 (488) and Begay No. 1 (659)  
Red Valley Chapter, Navajo Nation**






## Legend

### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

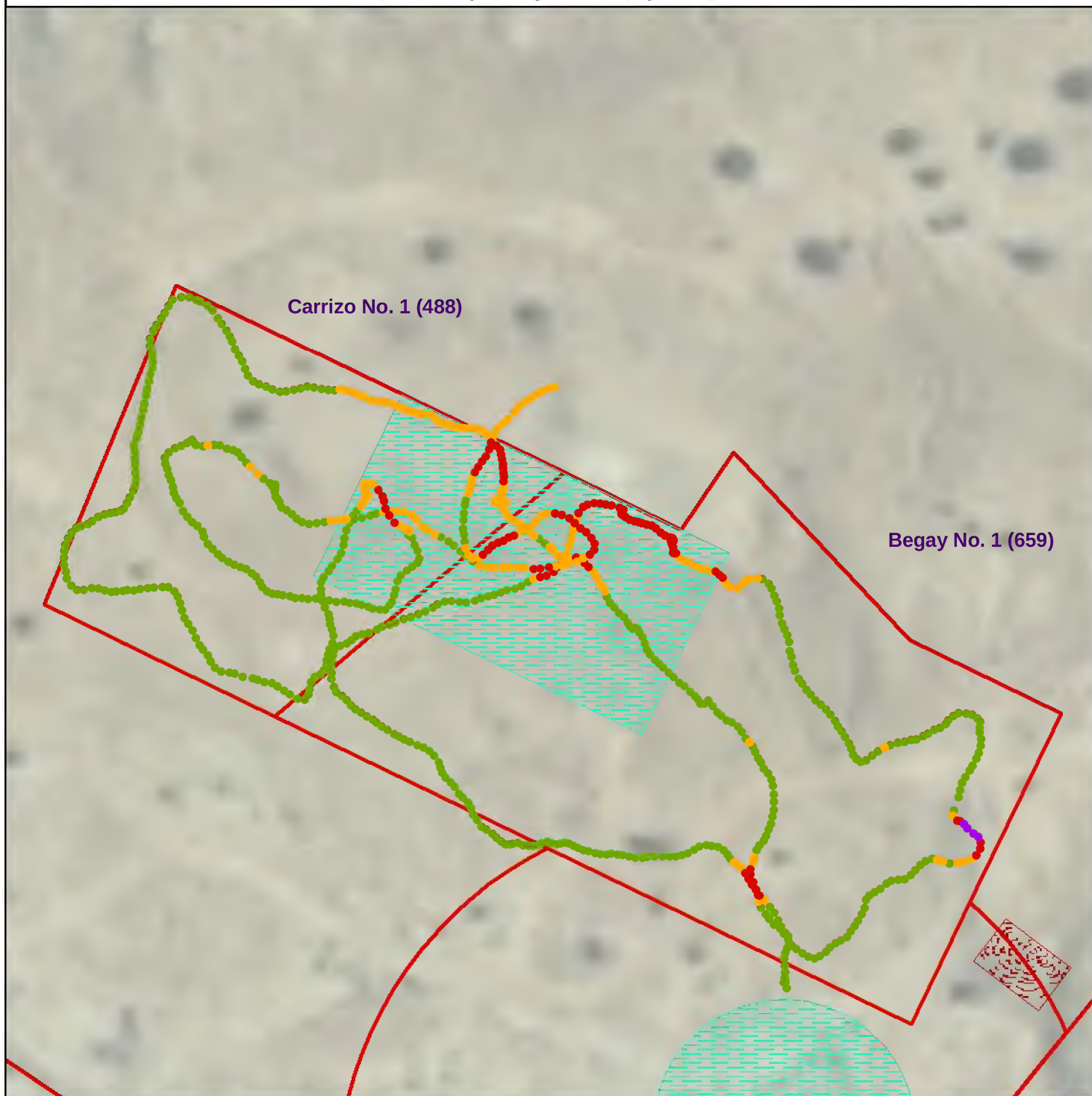
Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 10,154 cpm

-  Observed Reclamation Cap
-  General Direction Down-Slope
-  Mine Claim Boundaries






**Figure A-44 - Gamma Radiation Measurements  
Carrizo No. 1 (488) and Begay No. 1 (659)  
Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000

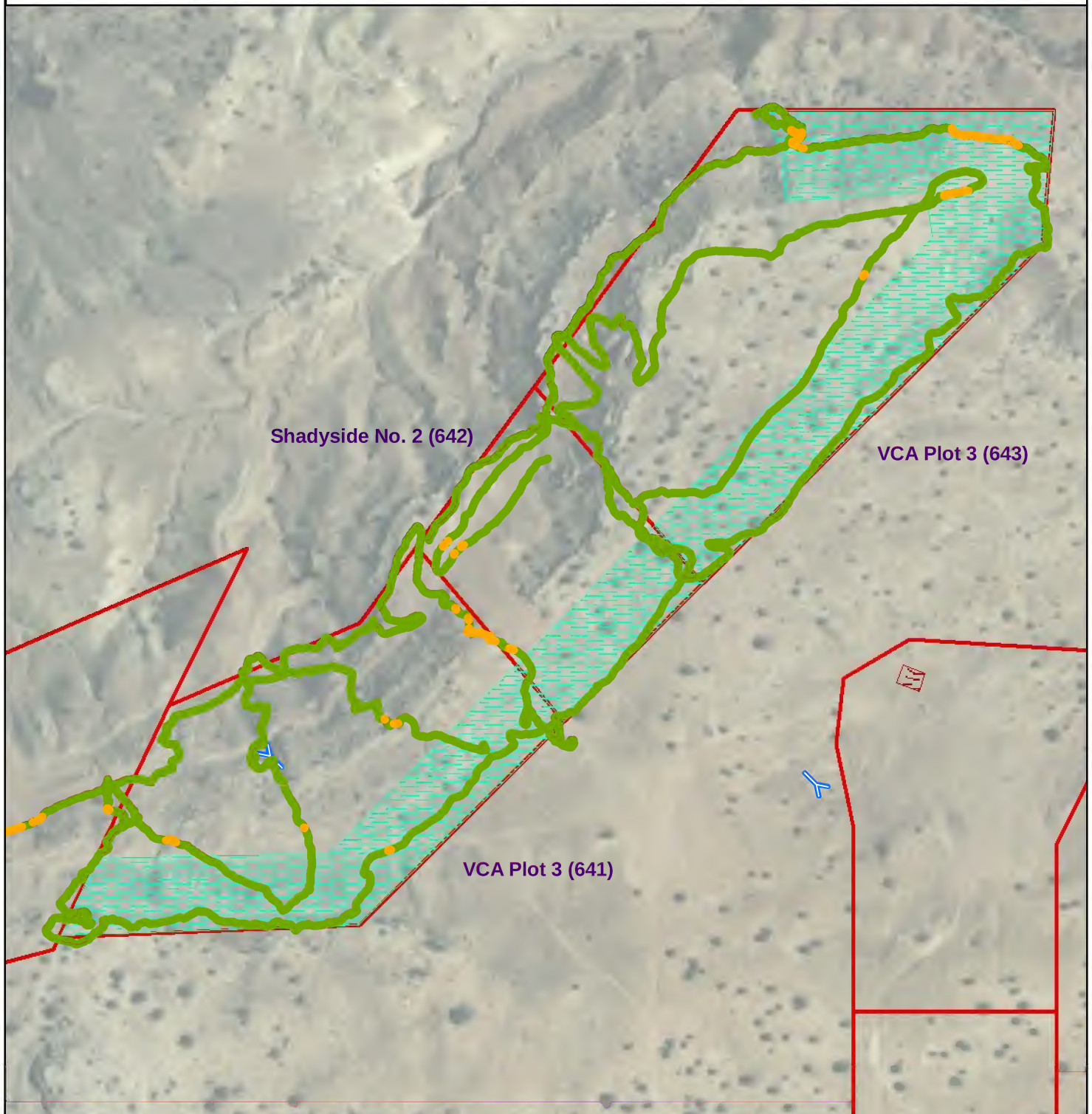
-  Observed Reclamation Cap
-  General Direction Down-Slope
-  Mine Claim Boundaries

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background 10,154 cpm



**Figure A-45 - Gamma Radiation Measurements, Above Two Times Background  
VCA Plot 3 (641), Shadyside No. 2 (642), and VCA Plot 3 (643)  
Red Valley Chapter, Navajo Nation**



### Legend

#### Gamma Radiation Measurements

- < 2X Background
- > 2X Background

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background = 11,535 cpm

- Observed Adit
- Observed Reclamation Cap
- General Direction Down-Slope
- Mine Claim Boundaries

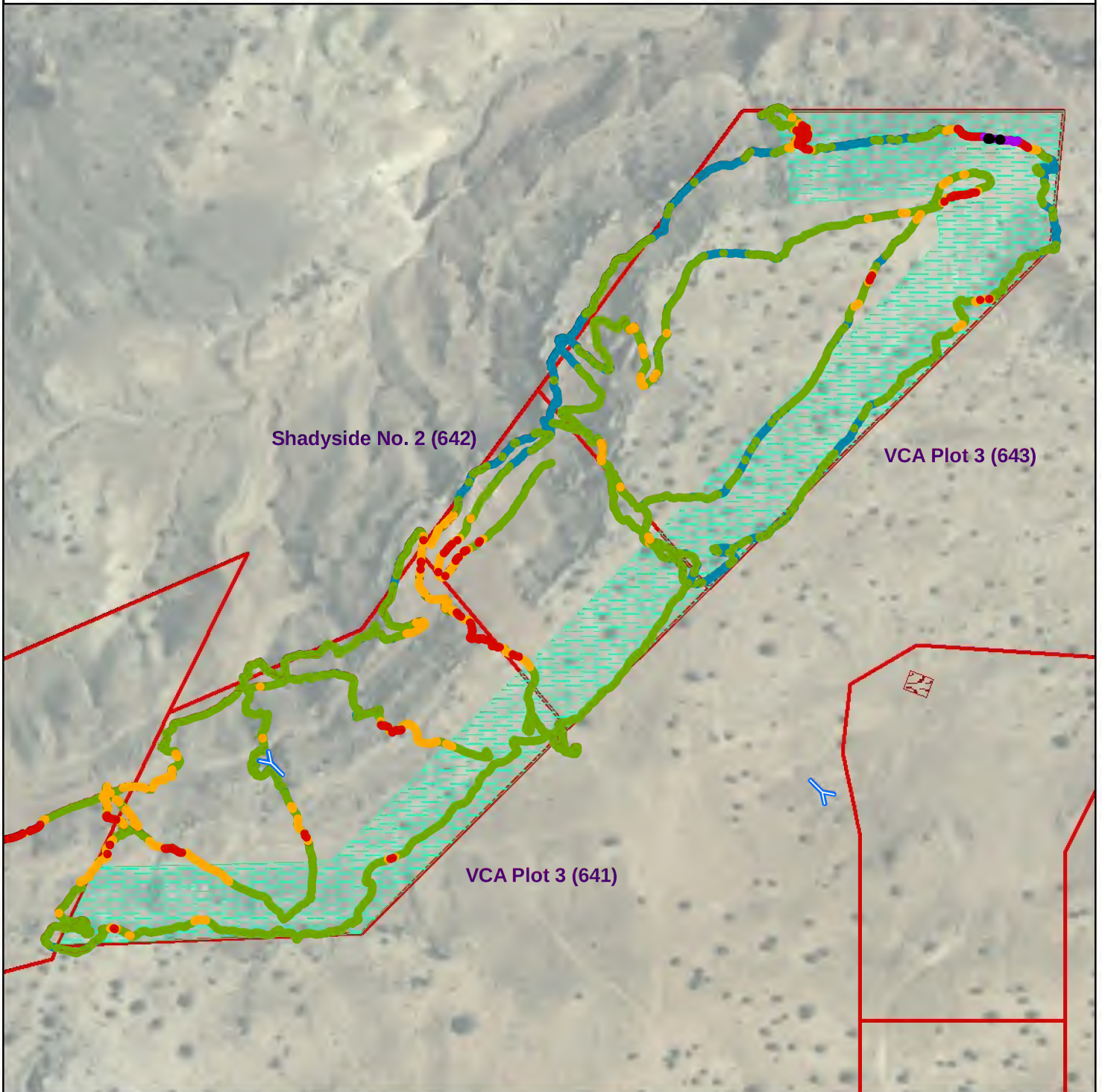


0 Feet  
480



**WESTON**  
SOLUTIONS

**Figure A-46 - Gamma Radiation Measurements  
VCA Plot 3 (641), Shadyside No. 2 (642), and VCA Plot 3 (643)  
Red Valley Chapter, Navajo Nation**



**Legend**

**Gamma Radiation Measurements**

- 0 - 10,000
- 10,000 - 15,000
- 15,000 - 20,000
- 20,000 - 50,000
- 50,000 - 100,000
- > 100,000



Observed Adit



Observed Reclamation Cap



General Direction Down-Slope



Mine Claim Boundaries

Gamma survey conducted 06/2010  
Measured as counts per minute (cpm)

Average background 11,535 cpm



**APPENDIX A:  
Transmittal List**

## **TRANSMITTAL LIST**

**Date: September 2008**

**Site Name: King Tutt Mesa Site**

**EPA ID No.: NND986667434**

A copy of the Reassessment Report for the King Tutt Mesa Site should be sent to the following people:

Eugene Esplain  
Navajo Superfund Program  
Navajo Nation EPA  
P.O. Box 2946  
Window Rock, AZ 86515

Melvin Yazzie  
Navajo AML Shiprock Office  
P.O. Box 3605  
Shiprock, NM 87420

JC Begay  
Chapter President  
Red Valley Chapter  
P.O. Box 304  
Red Valley, Arizona 86544

**APPENDIX B:**  
**Site Reconnaissance Interview and Observation Report/  
Photographic Documentation**

## **SITE RECONNAISSANCE INTERVIEW AND OBSERVATIONS REPORT/PHOTOGRAPHIC DOCUMENTATION**

**DATE:** July 1 and July 3, 2008

**OBSERVATIONS MADE BY:** Joseph DeFao

**SITE:** King Tutt Mesa Site

**EPA ID:** NND986667434

Site visits were conducted on July 1 and July 3, 2008. The following information was obtained and photographs were taken during the site visit:

On July 1, 2008, personnel from the U.S. Environmental Protection Agency (EPA), the Navajo Nation Environmental Protection Agency (NNEPA), and Weston Solutions, Inc. (WESTON) arrived at the northern portion of the King Tutt Mesa Aggregate Site (KTM) at approximately 8:00 pm. The following people were present: Jeff Inglis (EPA), Stanley Edison (NNEPA) and Joe DeFao, Nels Johnson, and Tommy Evans (WESTON). The NNEPA provided WESTON with a general orientation of the Oak Springs and VCA Plot 7 Mines prior to running out of daylight.

On July 3, 2008, WESTON met with Melvin Yazzie from the Navajo Abandoned Mine Lands Reclamation Program (NAMLRP). For approximately one hour, the NAMLRP provided WESTON personnel with an orientation of the southern section of the KTM Site, including the following mines: Begay No. 1, Shadyside No.1, NA-0806, VCA Plot 3, and Lookout Point. During the orientation, Mr. Yazzie explained various reclamation activities conducted by the NAMLRP, such as the installation soil caps to cover previously mined areas. In an effort to help identify the capped areas, Mr. Yazzie pointed out that the caps have a darker red soil than the surrounding native soil. Upon completion of the orientation, WESTON began collecting gamma radiation measurements using a combination sodium-iodide scintillation detector and a global positioning system (GPS) unit. A stand-alone scintillation detector was used as well. The gamma survey equipment consisted of a Ludlum Model 2221 Scaler/Ratemeter and a Ludlum Model 44-10 Gamma Scintillator, which is a 2 inch by 2 inch sodium-iodide gamma radiation detector. The Ludlum instruments were connected to a Trimble GPS system to provide coordinates for the gamma measurements.

Background radiation measurements were collected to the south of the Begay No. 1 Mine, in an area that appeared to be undisturbed by mining activities. The average background gamma radiation level was 11,148 counts per minute (cpm). WESTON continued to collect gamma radiation measurements throughout the KTM Site at all of the mine areas that could be identified during the site visit. WESTON identified an eroded section of a cap at the VCA Plot 7 Mines, with gamma measurements in excess of 100,000 cpm. Elevated readings were detected in a natural drainage channel that

*Photographic Documentation  
King Tutt Mesa Site  
Apache County, Arizona*

extended from the northeast corner of Nelson Point Mine through the Tent Mine. Additionally, elevated readings were detected at a portion of the cap at NA-0806 that has subsided; however, this area was previously identified by NAMLPA for future maintenance, and the subsided area is currently fenced off.

During the site visit, WESTON did not encounter any barriers to the mines aside from the fenced area around the subsidence at NA-0806. However, due to the rugged and remote terrain, access to all of the mine sites was via dirt roads with high clearance vehicles. WESTON identified one residence located the northwest of the Oak Springs Mine. Agricultural fields near this residence were observed. WESTON did not observe any residences, schools, or daycare facilities within 200 feet of the mine sites.

*Photographic Documentation  
King Tutt Mesa Site  
Apache County, Arizona*



**Photo 1: WESTON collecting gamma radiation measurements along a steep slope of the Oak Springs Mine.**



**Photo 2: WESTON detected gamma measurements in excess of 100,000 cpm in an eroded section of the cap at the VCA Plot 7 Mines.**

*Photographic Documentation  
King Tutt Mesa Site  
Apache County, Arizona*



**Photo 3: View of the Oak Spring Wash adjacent to the VCA Plot 7 Mines.**



**Photo 4: WESTON used a combination sodium-iodide scintillation detector and a GPS unit (right). A stand-alone scintillation detector also was used (left).**

*Photographic Documentation  
King Tutt Mesa Site  
Apache County, Arizona*



**Photo 5: A section of the cap at NA-0806 has subsided. The NAMLRP has identified the area and surrounded it with a fence.**



**Photo 6: WESTON detected elevated gamma radiation measurements in a natural drainage channel (left) that extends from the northeast corner of Nelson Point Mine.**

*Photographic Documentation  
King Tutt Mesa Site  
Apache County, Arizona*



**Photo 7: View of the reclamation cap at the Shadyside No. 1 Mine from the Lookout Point Mine. The darker red soil in the center of the photo is the cap.**



**Photo 8: View of WESTON collecting gamma radiation measurements at capped section of the Lookout Point Mine.**

*Photographic Documentation  
King Tutt Mesa Site  
San Juan County, New Mexico*



**Photo 9: Navajo Superfund Program 2004 sampling event.**



**Photo 10: Navajo Superfund Program 2004 sampling event.**

*Photographic Documentation  
King Tutt Mesa Site  
San Juan County, New Mexico*



**Photo 11: Navajo Superfund Program 2004 sampling event.**



**Photo 12: Navajo Superfund Program 2004 sampling event.**

*Photographs taken by Navajo Superfund Program.*

*Photographic Documentation  
King Tutt Mesa Site  
San Juan County, New Mexico*



**Photo 13: Navajo Superfund Program 2004 sampling event.**



**Photo 14: Navajo Superfund Program 2004 sampling event.**

*Photographic Documentation  
King Tutt Mesa Site  
San Juan County, New Mexico*



**Photo 15: Navajo Superfund Program 2004 sampling event.**



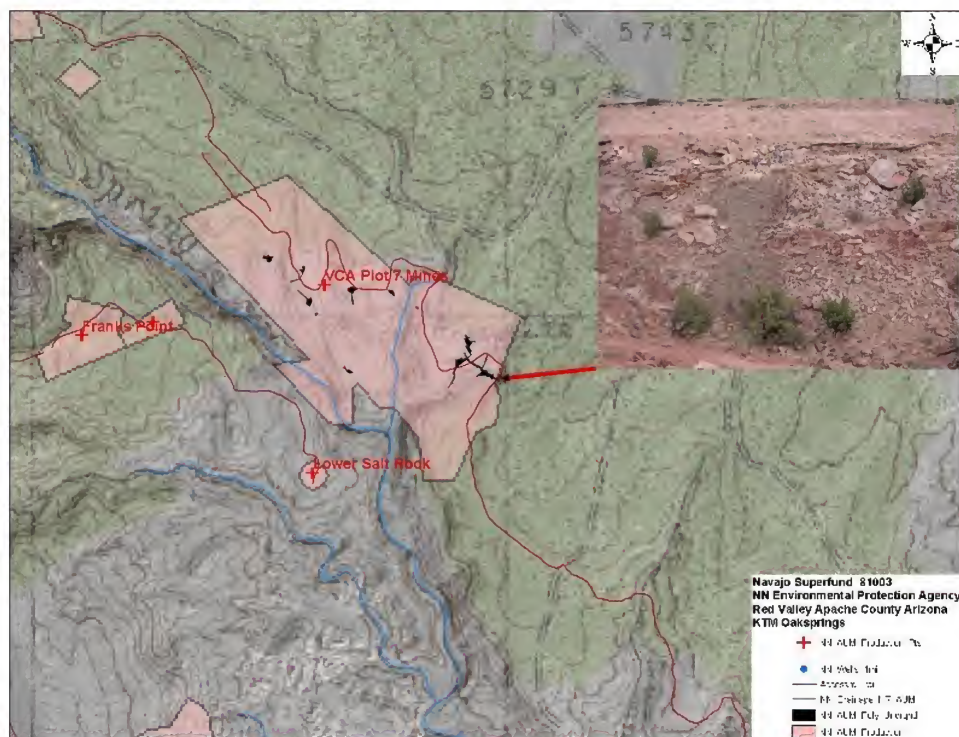
**Photo 16: Navajo Superfund Program 2004 sampling event.**

*Photographs taken by Navajo Superfund Program.*

*Photographic Documentation  
King Tutt Mesa Site  
San Juan County, New Mexico*



**Photo 17: Mine waste at a section of the VCA Plot 7 Mine.**



**Photo 18: Location of the mine waste at the VCA Plot 7 Mine.**

**APPENDIX C:**  
**Contact Log and Contact Reports**

## CONTACT LOG

**SITE: King Tutt Mesa Site**  
**EPA ID NO.: NND986667434**

NAME	AFFILIATION	PHONE	DATE	INFORMATION
Lily Lane	Navajo Nation EPA	(928) 871-6092	8-27-08	See Contact Report
Moses Yesslith	Navajo Tribal Utility Authority	(505) 368-4639	8-29-08	See Contact Report

### CONTACT REPORT 1

AGENCY/AFFILIATION: Navajo Nation Environmental Protection Agency		
DEPARTMENT: Surface and Groundwater Protection Department		
ADDRESS/CITY: P.O. Box 339		
COUNTY/STATE/ZIP: Window Rock, Arizona 86515		
CONTACT(S)	TITLE	PHONE
Lily Lane	Water Quality Engineer	(928) 871-6092
PERSON MAKING CONTACT: Joe De Fao		DATE: 8-27-08
SUBJECT: Oak Springs community water system		
SITE NAME: King Tutt Mesa Site		EPA ID#: NND986667434

DISCUSSION: Lily Lane at the Navajo Nation Environmental Protection Agency was contacted to provide information on the drinking water system that serves the Oak Springs community adjacent to the KTM Site. Ms. Lane did not have any information on this water system.

## CONTACT REPORT 2

AGENCY/AFFILIATION: Navajo Tribal Utility Authority		
DEPARTMENT: Shiprock District Office		
ADDRESS/CITY: P.O. Box 1749		
COUNTY/STATE/ZIP: Shiprock, New Mexico, 87420		
CONTACT(S)	TITLE	PHONE
Moses Yesslith	Master System Operator	(505) 368-4639
PERSON MAKING CONTACT: Joe De Fao		DATE: 8-29-08
SUBJECT: Oak Springs community water system		
SITE NAME: King Tutt Mesa Site		EPA ID#: NND986667434

DISCUSSION: Moses Yesslith at the Navajo Tribal Utility Authority was contacted to provide information on the drinking water system that serves the Oak Springs community adjacent to the KTM Site. Mr. Yesslith stated that the Oak Springs community is served by a connection to the Hidden Springs well in Cove, Arizona. Mr. Yesslith stated that the water from this connection is pumped directly into water lines that service the residents in this area, and that there would be no need for residents to obtain water from other sources.

## **APPENDIX D: Analytical Data**

## **APPENDIX E**

### **References**

**APPENDIX F**  
**EPA Quick Reference Fact Sheet**



# SITE ASSESSMENT: Evaluating Risks at Superfund Sites

Office of Emergency and Remedial Response  
Hazardous Site Evaluation Division 5204G

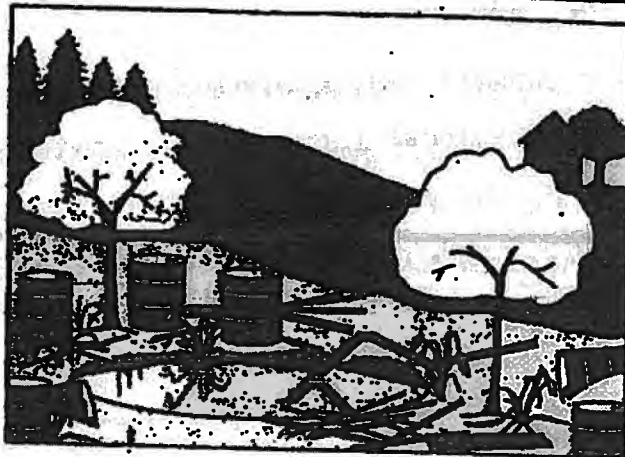
Quick Reference Fact Sheet

## The Challenge of the Superfund Program

A series of headline-grabbing stories in the late 1970s, such as Love Canal, gave Americans a crash course in the perils of ignoring hazardous waste. At that time, there were no Federal regulations to protect the country against the dangers posed by hazardous substances (mainly industrial chemicals, accumulated pesticides, cleaning solvents, and other chemical products) abandoned at sites throughout the nation. And so, in 1980 Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, to address these problems.

The major goal of the Superfund program is to protect human health and the environment by cleaning up areas, known as "sites," where hazardous waste contamination exists. The U.S. Environmental Protection Agency (EPA) is responsible for implementing the Superfund program.

At the time it passed the Superfund law, Congress believed that the problems associated with uncontrolled releases of hazardous waste could be



handled in five years with \$1.6 billion dollars. However, as more and more sites were identified, it became apparent that the problems were larger than anyone had originally believed. Thus, Congress passed the Superfund Amendments and Reauthorization Act (SARA) in 1986. SARA expanded and strengthened the authorities given to EPA in the original legislation and provided a budget of \$8.5 billion over five years. Superfund was extended for another three years in 1991.

## What is EPA's Job at Superfund Sites?

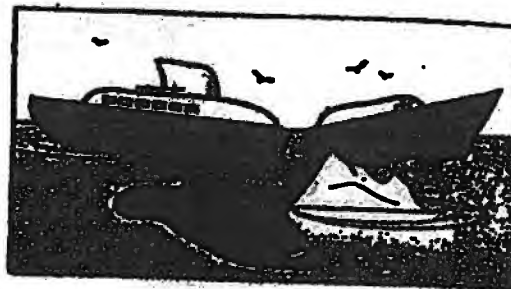
For more than 10 years, EPA has been implementing the Superfund law by:

- Evaluating potential hazardous waste sites to determine if a problem exists;
- Finding the parties who caused the hazardous waste problems and directing them to address these problems under EPA oversight or requiring them to repay EPA for addressing these problems; and
- Reducing immediate risks and tackling complex hazardous waste problems.

The Superfund site assessment process generally begins with the discovery of contamination at a site and ends with the completion of remediation (i.e., cleaning up the waste at a site) activities. This fact sheet explains the early part of the process, called the *site assessment* phase.

## The National Response Center

The National Response Center (NRC), staffed by Coast Guard personnel, is the primary agency to contact for reporting all oil, chemical, and biological discharges into the environment anywhere in the U.S. and its territories. It is responsible for:



- Maintaining a telephone hotline 365 days a year, 24 hours a day;
- Providing emergency response support in specific incidents; and
- Notifying other Federal agencies of reports of pollution incidents.

To report a pollution incident, such as an oil spill, a pipeline system failure, or a transportation accident involving hazardous material, call the NRC hotline at 800-424-8802.

# 1

### Site Discovery

Hazardous waste sites are discovered in various ways. Sometimes concerned residents find drums filled with unknown substances surrounded by dead vegetation and call the NRC, EPA, or the State environmental agency; or an anonymous caller to the NRC or EPA reports suspicious dumping activities. Many sites come to EPA's attention through routine inspections conducted by other Federal, State, or local government officials. Other sites have resulted from a hazardous waste spill or an explosion. EPA enters these sites into a computer system that tracks any future Superfund activities.

# 2

### Preliminary Assessment

After learning about a site, the next step in the site assessment process is to gather existing information about the site. EPA calls this the *preliminary assessment*. Anyone can request that a preliminary assessment be performed at a site by petitioning EPA, the State environmental agency, local representatives, or health officials.

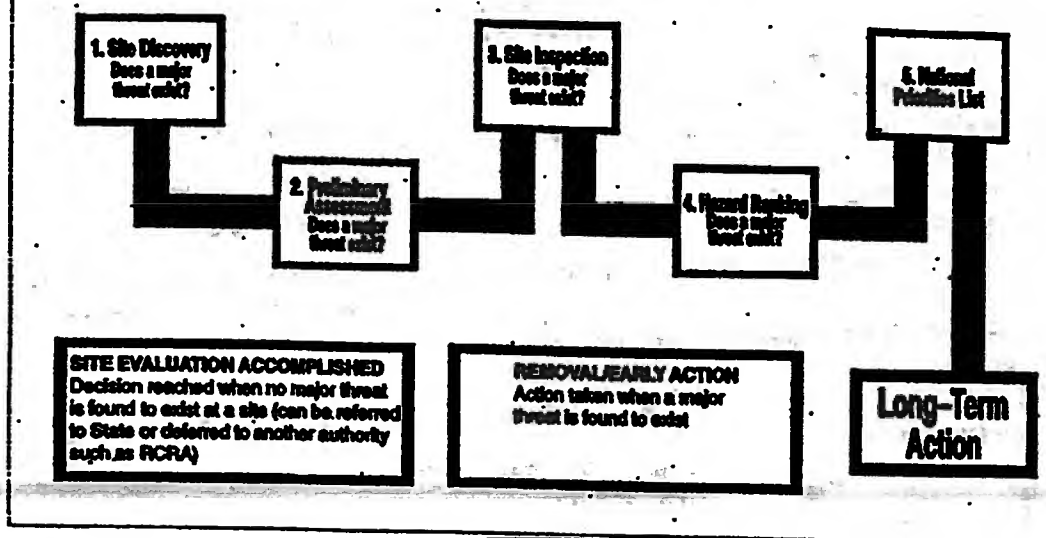
During the preliminary assessment, EPA or the State environmental agency:

- ◆ Reviews available background records;
- ◆ Determines the size of the site and the area around it;

- ◆ Tries to determine whether hazardous substances are involved;
- ◆ Identifies actual or potential pollution victims, such as the nearby population and sensitive environments;
- ◆ Makes phone calls or interviews people who may be familiar with the site; and
- ◆ Evaluates the need for early action using EPA's removal authority.

By gathering information and possibly visiting the site, EPA or the State environmental agency is able to determine if major threats exist and if cleanup is needed. Many times, the preliminary assessment indicates that no major threats exist.

## The Site Assessment Process



*However, if hazardous substances do pose an immediate threat, EPA quickly acts to address the threat.* When a site presents an immediate danger to human health or the environment—for example, there is the potential for a fire or an explosion or the drinking water is contaminated as a result of hazardous substances leaking out of drums—EPA can move quickly to address site contamination. This action is called a *removal* or an *early action*. Additional information on early actions can be found on page 4.

EPA or the State environmental agency then decides if further Federal actions are required. Of the more than 35,000 sites discovered since 1980, only a small percentage have needed further remedial action under the Federal program.

A report is prepared at the completion of the preliminary assessment. The report includes a description of any hazardous substance release, the possible source of the release, whether the contamination could endanger people or the environment, and the pathways of the release. The information outlined in this report is formed into hypotheses that are tested if further investigation takes place. You can request a copy of this report once it becomes final—just send your name and address to your EPA regional Superfund office. See page 8 for further information on these contacts.

Sometimes it is difficult to tell if there is contamination at the site based on the initial information gathering. When this happens, EPA moves on to the next step of the site assessment, called the *site inspection*.

## Making Polluters Pay

One of the major goals of the Superfund program is to have the responsible parties pay for or conduct remedial activities at hazardous waste sites. To accomplish this goal, EPA:

- ◆ Researches and determines who is responsible for contaminating the site;
- ◆ Issues an order requiring the private parties to perform cleanup actions with EPA oversight; and
- ◆ Recovers costs that EPA spends on site activities from the private parties.

## Removals/Early Actions

EPA can take action quickly if hazardous substances pose an immediate threat to human health or the environment. These actions are called *removals* or *early actions* because EPA rapidly eliminates or reduces the risks at the site. EPA can take a number of actions to reduce risks, including:

- ◆ Fencing the site and posting warning signs to secure the site against trespassers;
- ◆ Removing, containing, or treating the source of the contamination;
- ◆ Providing homes and businesses with safe drinking water; and, as a last resort,
- ◆ Temporarily relocating residents away from site contamination.

**"EPA can take action quickly if hazardous substances pose an immediate threat to human health or the environment."**

# 3

## Site Inspection

If the preliminary assessment shows that hazardous substances at the site may threaten residents or the environment, EPA performs a site inspection. During the site inspection, EPA or the State collects samples of the suspected hazardous substances in nearby soil and water. EPA may initiate a concurrent SI/remedial investigation at those sites that are most serious and determined early as requiring long-term action. Sometimes, wells have to be drilled to sample the ground water. Site inspectors may wear protective gear, including coveralls and respirators, to protect themselves against any hazardous substances present at the site. Samples collected during the site inspection are sent to a laboratory for analysis to help EPA answer many questions, such as:

- ◆ Are hazardous substances present at the site? If so, what are they, and approximately

how much of each substance is at the site?

- ◆ Have these hazardous substances been released into the environment? If so, when did the releases occur, and where did they originate?
- ◆ Have people been exposed to the hazardous substances? If so, how many people?
- ◆ Do these hazardous substances occur naturally in the immediate area of the site? At what concentrations?
- ◆ Have conditions at the site gotten worse since the preliminary assessment? If so, is an early action or removal needed? (See box above.)

Often, the site inspection indicates that there is no release of major contamination at the site, or that the hazardous substances are safely contained and have no possibility of being released into the environment. In these situations, EPA decides that no further Federal inspections or remedial actions are needed. This decision is referred to as *site evaluation accomplished*. (See page 5 for more details on the *site evaluation accomplished* decision.)

At the completion of the site inspection, a report is prepared. This report is available to the public—call your EPA regional Superfund office for a copy. See page 8 for the phone numbers of these offices.

**"During the site inspection, EPA or the State collects samples of the suspected hazardous substances in nearby soil and water."**

At sites with particularly complex conditions, EPA may need to perform a second SI to obtain legally defensible documentation of the releases.

Because EPA has limited resources, a method has been developed to rank the sites and set priorities throughout the nation. That method, known as the *Hazard Ranking System*, is the next step in the site assessment process.

# 4

## Hazard Ranking System

EPA uses the information collected during the preliminary assessment and site inspection to evaluate the conditions at the site and determine the need for long-term remedial actions. When evaluating the seriousness of contamination at a site, EPA asks the following questions:

- ◆ Are people or sensitive environments, such as wetlands or endangered species, on or near the site?
- ◆ What is the toxic nature and volume of waste at the site?
- ◆ What is the possibility that a hazardous substance is in or will escape into ground water, surface water, air, or soil?

Based on answers to these questions, each site is given a score between zero and 100. Sites that score 28.5 or above move to the next step in the process: listing on the *National Priorities List*. Sites that score below 28.5 are referred to the State for further action.

# 5

## National Priorities List

Sites that are listed on the *National Priorities List* present a potential threat to human health and the environment, and require further study to determine what, if any, remediation is necessary. EPA can pay for and conduct

## Site Evaluation Accomplished

In many instances, site investigators find that potential sites do not warrant Federal action under the Superfund program. This conclusion can be attributed to one of two reasons:

- ◆ The contaminants present at the site do not pose a major threat to the local population or environment; or
- ◆ The site should be addressed by another Federal authority, such as EPA's Resource Conservation and Recovery Act (RCRA) hazardous waste management program.

When investigators reach this conclusion, the site evaluation is considered accomplished. A site can reach this point at several places during the site assessment process, namely at the conclusion of the preliminary assessment or the site inspection, or once the site is scored under the Hazard Ranking System.

remedial actions at NPL sites if the responsible parties are unable or unwilling to take action themselves. There are three ways a site can be listed on the National Priorities List:

- ◆ It scores 28.5 or above on the Hazard Ranking System;
- ◆ If the State where the site is located gives it top priority, the site is listed on the National Priorities List regardless of the HRS score; or
- ◆ EPA lists the site, regardless of its score, because all of the following are true about the site:

- ▼ The Agency for Toxic Substances and Disease Registry (ATSDR), a group within the U.S. Public Health Service, issues a health advisory recommending that the local population be *dissociated* from the site (i.e., that the people be temporarily relocated or the immediate public health threat be removed);
- ▼ EPA determines that the site poses a significant threat to human health; and
- ▼ Conducting long-term remediation activities will be more effective than

addressing site contamination through early actions.

The list of proposed sites is published in the *Federal Register*, a publication of legal notices issued by Federal agencies. The community typically has 60 days to comment on the list. After considering all comments, EPA publishes a list of those sites that are officially on the National Priorities List. When a site is added to the National Priorities List, the site assessment is completed. Long-term actions take place during the next phase. See page 6 for more details on long-term actions.

## As a Concerned Citizen, How Can I Help?

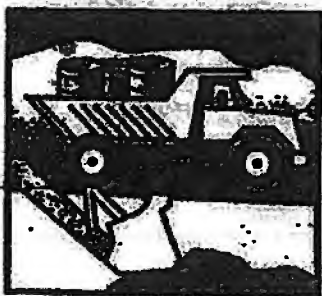
- ☛ Read this fact sheet.
- ☛ Call EPA with any potential sites in your area.
- ☛ Provide EPA with site information.
- ☛ Comment on proposed listing of sites on the National Priorities List.
- ☛ If the site is listed on the NPL, work with your citizens' group to apply for a technical assistance grant.



## Addressing Sites in the Long Term

Once a site is placed on the National Priorities List, it enters the long-term or remedial phase. The stages of this phase include:

- ✓ Investigating to fully determine the nature and extent of contamination at the site, which can include a public health assessment done by the ATSDR;
- ✓ Exploring possible technologies to address site contamination;
- ✓ Selecting the appropriate technologies—also called remedies;
- ✓ Documenting the selected remedies in a record of decision (ROD);
- ✓ Designing and constructing the technologies associated with the selected remedies;
- ✓ If necessary, operating and maintaining the technologies for several years (e.g., long-term treatment of ground water) to ensure safety levels are reached; and
- ✓ Deleting the site from the National Priorities List, completing Superfund's process and mission.



## Some Commonly Asked Questions

**Q:** What exactly is a site?

**A:** EPA designates the area in which contamination exists as the "site." Samples are taken to define the area of contamination. At any time during the cleanup process the site may be expanded if contamination is discovered to have spread further.

**Q:** How long will it take to find out if a threat exists?

**A:** Within one year of discovering the site, EPA must perform a preliminary assessment. The preliminary assessment allows EPA to determine if there is an immediate danger at the site; if so, EPA takes the proper precautions. You will be notified if you are in danger. EPA may also contact you to determine what you know about the site.

**Q:** What is the State's role in all these investigations?

**A:** The State can take the lead in investigating and addressing contamination. It also provides EPA with background information on (1) immediate threats to the population or environment, and (2) any parties that might be responsible for site contamination. The State shares in the cost of any long-term actions conducted by the Superfund program, comments on the proposal of sites to the National Priorities List, and concurs on the selected remedies and final deletion of sites from the National Priorities List.

**Q:** Why are private contractors used to assess sites?

**A:** EPA has a limited workforce. By using private contractors, EPA is able to investigate more sites. Also, EPA is able to draw on the expertise of private contracting companies.

**Q:** Why are there so many steps in the evaluation process? Why can't you just take away all the contaminated materials right now, just to be safe?

**A:** When EPA assesses a site, it first determines if contamination poses any threats to the health of the local population and the integrity of the environment. Dealing with worst sites first is one of Superfund's national goals. By evaluating contamination in a phased approach, EPA can quickly identify sites that pose the greatest threats and move them through the site assessment process. Once EPA understands the conditions present at a site, it searches for the remedy that will best protect public health and the environment. Cost is only one factor in weighing equally protective remedies. Many sites do not warrant actions because no major threat exists. However, if a significant threat does exist, EPA will take action.